PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
WPP79820		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 00/00325	04/02/2000	05/02/1999
Applicant		
MINOP LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 2

   [X] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

National Application No
PCT/GB 00/00325

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B17/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 701 832 A (BLUET JEAN LUC ;LECLERC YVES) 2 September 1994 (1994-09-02) page 3, line 23 -page 4, line 28; figures 1,2	11-13, 17-19, 26-28,30
Y	---	29
Y	WO 96 24298 A (DEVLIN STUART LESLIE ;DAMPNEY IAN TREVOR (GB)) 15 August 1996 (1996-08-15) cited in the application abstract page 5, paragraph 5 figure 1	29
A	---	1-3, 8-10,20, 21,23, 24,31
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 May 2000	12/05/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ducreau, F

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 653 729 A (CHAPPUIS MICHAEL C ET AL) 5 August 1997 (1997-08-05) column 1, line 55 -column 2, line 3; figures 1-4	11,17, 19,26
A	DE 35 26 821 A (HENSLER EWALD) 5 February 1987 (1987-02-05) the whole document	1-3, 8-10, 20-24,31
A	US 5 355 871 A (HURLEY PAUL ET AL) 18 October 1994 (1994-10-18) the whole document	1-3, 8-10,20, 21,23, 24,31
A	US 4 760 848 A (HASSON HARRITH M) 2 August 1988 (1988-08-02) abstract; figures 1,4	1-3, 8-10, 20-24,31
A	US 5 715 604 A (LANZONI MAURICE) 10 February 1998 (1998-02-10) abstract; figures 2,4,5	11,17, 19,26

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 00/00325

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2701832 A	02-09-1994	NONE	
WO 9624298 A	15-08-1996	AU 4492396 A EP 0808133 A	27-08-1996 26-11-1997
US 5653729 A	05-08-1997	US 5876420 A	02-03-1999
DE 3526821 A	05-02-1987	NONE	
US 5355871 A	18-10-1994	NONE	
US 4760848 A	02-08-1988	NONE	
US 5715604 A	10-02-1998	FR 2735350 A EP 0748614 A	20-12-1996 18-12-1996

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ EP 1 September 2000

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION

Applicant's or agent's file reference: WPP79820

International application No.	International filing date *(day/month/year)*	(Earliest) Priority date *(day/month/year)*
PCT/GB00/00325	4 February 2000 (04.02.2000)	5 February 1999 (05.02.1999)

Title of invention: Actuating and Locking Mechanism for a Surgical Tool

Box No. II APPLICANT(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

MinOp Limited
29 Devonshire Place
London W1N 1PE
United Kingdom

Telephone No.:

Facsimile No.:

Teleprinter No.:

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
GB	GB

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Dampney, Ian Trevor
Random Technologies Ltd
326 Kensal Road
London W10 5BZ
United Kingdom

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
	GB

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Wickham, John Ewant Alfred
29 Devonshire Place
London W1N 1PE
United Kingdom

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
	GB

☐ Further applicants are indicated on a continuation sheet.

International application No.
PCT/GB00/00325

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is ☒ agent ☐ common representative

and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.

☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Devons, David Jon
Marks & Clerk
57-60 Lincoln's Inn Fields
London WC2A 3LS
United Kingdom

Telephone No.: 020-7400-3000

Facsimile No.: 020-7404-4910

Teleprinter No.: 25311 EMANDC G

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments:*

1. The applicant wishes the international preliminary examination **to start on the basis of:**

☐ the international application as originally filed

the description ☒ as originally filed
☐ as amended under Article 34

the claims ☐ as originally filed
☒ as amended under Article 19 (together with any accompanying statement)
☐ as amended under Article 34

the drawings ☒ as originally filed
☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ The applicant wishes the start of the international preliminary examination **to be postponed** until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed.
☐ which is the language of a translation furnished for the purposes of international search.
☐ which is the language of publication of the international application.
☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby **elects all eligible States** *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes **not to elect:**

Sheet No. 3

International application No.
PCT/GB00/00325

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:			For International Preliminary Examining Authority use only: received	not received
1. translation of international application	:	sheets	☐	☐
2. amendments under Article 34	:	sheets	☐	☐
3. copy (or, where required, translation) of amendments under Article 19	: 3	sheets	☐	☐
4. copy (or, where required, translation) of statement under Article 19	:	sheets	☐	☐
5. letter	: 1	sheets	☐	☐
6. other *(specify)*	:	sheets	☐	☐

The demand is also accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ nucleotide and or amino acid sequence listing in computer readable form
6. ☐ other *(specify)*:

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

Godwin, Edgar James on behalf of

Devons, David Jon

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* WPP79820

Box No. I TITLE OF INVENTION

Actuating and Locking Mechanism for a Surgical Tool

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

MinOp Limited
29 Devonshire Place
London W1N 1PE
United Kingdom

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Dampney, Ian Trevor
c/o Random Technologies Ltd
326 Kensal Road
London W10 5BZ
United Kingdom

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is,country)* of nationality:

State *(that is, country)* of residence: GB

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Devons, David Jon
Marks & Clerk
57-60 Lincoln's Inn Fields
London WC2A 3LS
United Kingdom

Telephone No. 0171-400-3000

Facsimile No. 0171-404-4910

Teleprinter No. 25311 EMANDC G

☐ **Adress for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Sheet No. 2

Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Wickham, John Ewart Alfred
29 Devonshire Place
London W1N 1PE
United Kingdom

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence: GB

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ☒ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **SD** Sudan, **SL** Sierra Leone, **SZ** Swaziland, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA** **Eurasian Patent:** **AM** Armenia, **AZ** Azerbaijan, **BY** Belarus, **KG** Kyrgyzstan, **KZ** Kazakhstan, **MD** Republic of Moldova, **RU** Russian Federation, **TJ** Tajikistan, **TM** Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** **European Patent:** **AT** Austria, **BE** Belgium, **CH and LI** Switzerland and Liechtenstein, **CY** Cyprus, **DE** Germany, **DK** Denmark, **ES** Spain, **FI** Finland, **FR** France, **GB** United Kingdom, **GR** Greece, **IE** Ireland, **IT** Italy, **LU** Luxembourg, **MC** Monaco, **NL** Netherlands, **PT** Portugal, **SE** Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA** **OAPI Patent:** **BF** Burkina Faso, **BJ** Benin, **CF** Central African Republic, **CG** Congo, **CI** Côte d'Ivoire, **CM** Cameroon, **GA** Gabon, **GN** Guinea, **GW** Guinea-Bissau, **ML** Mali, **MR** Mauritania, **NE** Niger, **SN** Senegal, **TD** Chad, **TG** Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- ☒ **AE** United Arab Emirates
- ☒ **AL** Albania
- ☒ **AM** Armenia
- ☒ **AT** Austria
- ☒ **AU** Australia
- ☒ **AZ** Azerbaijan
- ☒ **BA** Bosnia and Herzegovina
- ☒ **BB** Barbados
- ☒ **BG** Bulgaria
- ☒ **BR** Brazil
- ☒ **BY** Belarus
- ☒ **CA** Canada
- ☒ **CH and LI** Switzerland and Liechtenstein
- ☒ **CN** China
- ☒ **CU** Cuba
- ☒ **CZ** Czech Republic
- ☒ **DE** Germany
- ☒ **DK** Denmark
- ☒ **EE** Estonia
- ☒ **ES** Spain
- ☒ **FI** Finland
- ☒ **GB** United Kingdom
- ☒ **GD** Grenada
- ☒ **GE** Georgia
- ☒ **GH** Ghana
- ☒ **GM** Gambia
- ☒ **HR** Croatia
- ☒ **HU** Hungary
- ☒ **ID** Indonesia
- ☒ **IL** Israel
- ☒ **IN** India
- ☒ **IS** Iceland
- ☒ **JP** Japan
- ☒ **KE** Kenya
- ☒ **KG** Kyrgyzstan
- ☒ **KP** Democratic People's Republic of Korea
- ☒ **KR** Republic of Korea
- ☒ **KZ** Kazakhstan
- ☒ **LC** Saint Lucia
- ☒ **LK** Sri Lanka
- ☒ **LR** Liberia
- ☒ **LS** Lesotho
- ☒ **LT** Lithuania
- ☒ **LU** Luxembourg
- ☒ **LV** Latvia
- ☒ **MD** Republic of Moldova
- ☒ **MG** Madagascar
- ☒ **MK** The former Yugoslav Republic of Macedonia
- ☒ **MN** Mongolia
- ☒ **MW** Malawi
- ☒ **MX** Mexico
- ☒ **NO** Norway
- ☒ **NZ** New Zealand
- ☒ **PL** Poland
- ☒ **PT** Portugal
- ☒ **RO** Romania
- ☒ **RU** Russian Federation
- ☒ **SD** Sudan
- ☒ **SE** Sweden
- ☒ **SG** Singapore
- ☒ **SI** Slovenia
- ☒ **SK** Slovakia
- ☒ **SL** Sierra Leone
- ☒ **TJ** Tajikistan
- ☒ **TM** Turkmenistan
- ☒ **TR** Turkey
- ☒ **TT** Trinidad and Tobago
- ☒ **UA** Ukraine
- ☒ **UG** Uganda
- ☒ **US** United States of America
- ☒ **UZ** Uzbekistan
- ☒ **VN** Viet Nam
- ☒ **YU** Yugoslavia
- ☒ **ZA** South Africa
- ☒ **ZW** Zimbabwe

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☒ Any other PCT contracting state not listed above or on page 4

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn bythe applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

Supplemental Box *If the Supplemental Box is not used, this sheet should not be included in the request.*

*1. If, in any of the Boxes, **the space is insufficient** to furnish all the information: in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:*

*(i) **if more than two persons are involved as applicants and/or inventors** and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;*

*(ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication **"the States indicated in the Supplemental Box"** is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;*

*(iii) if, in Box No. II or in any of the sub-boxes of Box No. III, **the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America**: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;*

*(iv) if, in addition to the agent(s) indicated in Box No. IV, there are **further agents**: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;*

*(v) if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication **"patent of addition,"** or **"certificate of addition,"** or if, in Box No. V, the name of the United States of America is accompanied by an indication **"continuation"** or **"continuation-in-part"**: in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;*

*(vi) if, in Box No. VI, there are **more than three earlier applications whose priority is claimed**: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI;*

*(vii) if, in Box No. VI, **the earlier application is an ARIPO application**: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed.*

*2. If, with regard to the **precautionary designation statement** contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.*

*3. If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning **non-prejudicial disclosures or exceptions to lack of novelty**: in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.*

Continuation of Box V - Designation of States

CR - Costa Rica
DM - Dominica
MA - Morrocco
TZ - United Republic of Tanzania

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 5 Feb 99 (05.02.1999)	9902647.8	United Kingdom		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): 1

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*

ISA /

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date *(day/month/year)* Number Country *(or regional Office)*

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets**:

request	: 5
description (excluding sequence listing part)	: 12
claims	: 5
abstract	: 1
drawings	: 6
sequence listing part of description	:
Total number of sheets	: 29

This international application is **accompanied by** the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: Form 23/77

Figure of the drawings which should accompany the abstract: 2

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Mart J. C. Lamb

Lamb, Martin John Carstairs on behalf of
Devons, David Jon

For receiving Office use only

1. Date of actual receipt of the purported international application:	2. Drawings:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	☐ received:
4. Date of timely receipt of the required corrections under PCT Article 11(2):	☐ not received:
5. International Searching Authority (if two or more are competent): ISA /	6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Devons,david Jon.
MARKS & CLERK
57-60 Lincoln's Inn Fields
London WC2A 3LS
GRANDE BRETAGNE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	23.04.2001
Applicant's or agent's file reference WPP79820	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/00325	04/02/2000	05/02/1999

Applicant
MINOP LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

   The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

   Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

   For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Marra, E Tel.+49 89 2399-7235

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
WPP79820		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/00325	04/02/2000	05/02/1999
International Patent Classification (IPC) or national classification and IPC A61B17/28		
Applicant MINOP LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 9 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☐ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
01/09/2000	23.04.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Stern, M Telephone No. +49 89 2399 2239

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00325

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1,5-7,9,11,12	as originally filed			
2-4,8,10	as received on	09/02/2001	with letter of	08/02/2001

Claims, No.:

14-28	as amended under Article 19			
1-13	as received on	09/02/2001	with letter of	08/02/2001

Drawings, sheets:

1/6-6/6	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:
   ☐ the claims, Nos.:
   ☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)
   see separate sheet

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application.

   ☒ claims Nos. 1-28.

because:

   ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

   ☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 1-28 are so unclear that no meaningful opinion could be formed (*specify*):
   see separate sheet

   ☒ the claims, or said claims Nos. 1-28 are so inadequately supported by the description that no meaningful opinion could be formed.

   ☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the standard.
   ☐ the computer readable form has not been furnished or does not comply with the standard.

Regarding Section I:

1. The amendments introduced to both independent claims 1 and 11 do not satisfy the requirement of Art. 34(2)(b) PCT. The reasons are the following:

   In claim 1, the limitation of the actuating mechanism that its actuating pads should be ***"interleaving"*** has been eliminated. The vagueness of the expression after the last comma in claim 11 (as mentioned under point 3 below) has been compounded by introducing the expression of an ***"axial"*** depth of a stepped surface, without specifying to which "axis" this expression refers. Hence, the amendment in claim 11 is not supported by the original application.

2. Pursuant to Rule 70.2(c) PCT, the following will be based as if these amendments had not been made.

Regarding Section III:

1. The description states on page 2, paragraph 2 that the present application seeks: (a) to provide a sensitive control of actuation which is comfortable when the tool is held in a pen-like grip, and (b) to provide a mechanism for locking the tool into a plurality of different actuated positions.

   The present application comprises two different independent claims: claim 1, addressed at an actuating mechanism for actuating a surgical tool, and claim 11, addressed at a locking mechanism for locking a surgical tool. Independent claim 1 (actuating mechanism) does not provide any features to solve aforementioned problem (b), and independent claim 11 (locking mechanism) does not provide any features to solve problem (a).

   Consequently, none of the two independent claims contains all the essential features necessary to solve what the invention sets out to solve. Therefore the claims do not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

2. Moreover, claim 1 does not even recite anything more than what is disclosed in the closest prior art identified by the applicant himself, on page 2, paragraph 1:

   D1: WO-A-96/24 298

   In fact, this document also discloses an actuating mechanism for a surgical tool (cf abstract of D1) having a collapsible cage having a plurality of radially moveably, "interleaving" actuating pads. In fact, it the pads 23 of the present application are to be labelled as "interleaved", each one of pads 211 of Fig. 5 of D1 may just as well be termed as being "interleaved". Note that, at best, the finger-like elements of pads 23 in Fig. 6 of the present application seem to be "interleaved".

   Since the independent claims contain no clear and supported differentiation vis à vis the closest prior art identified in the description, again essential features are missing (see point 1 above).

3. The definition after the last comma in independent claim 11 concerning the difference of the depths of the steps of "actuator means" and the steps of "latching means" cannot be understood since any of the mentioned "means" has the function of "actuating" something and of "latching" something.

4. The aforementioned objections of lack of clarity and support in the description preclude any meaningful assessment of novelty and inventive step. Nevertheless, it seems appropriate to add the following observations.

4.1 To meet the requirements of Rule 6.3(b) PCT the independent claim should have been properly cast in the two part form, with those features which in combination are known from D1 being placed in the preamble.

4.2 Reference signs in parentheses should have been inserted in the claims to increase their intelligibility, Rule 6.2(b) PCT. This applies to both the preamble and characterising portion.

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : A61B 17/28

A1

(11) International Publication Number: WO 00/45718

(43) International Publication Date: 10 August 2000 (10.08.00)

(21) International Application Number: PCT/GB00/00325

(22) International Filing Date: 4 February 2000 (04.02.00)

(30) Priority Data:
9902647.8 5 February 1999 (05.02.99) GB

(71) Applicant *(for all designated States except US)*: MINOP LIMITED [GB/GB]; 29 Devonshire Place, London W1N 1PE (GB).

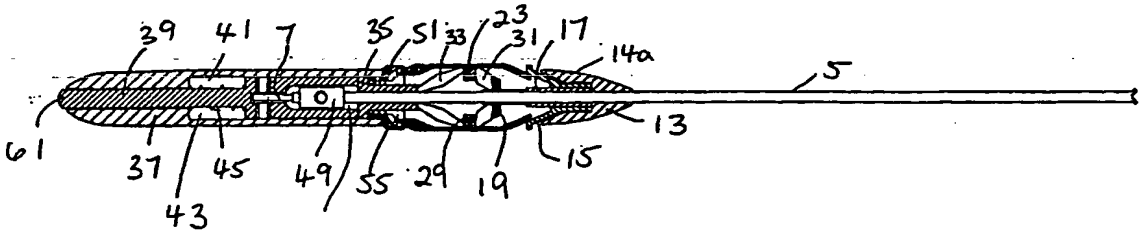
(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: DAMPNEY, Ian, Trevor [–/GB]; Random Technologies Ltd., 326 Kensal Road, London W10 5BZ (GB). WICKHAM, John, Ewant, Alfred [–/GB]; 29 Devonshire Place, London W1N 1PE (GB).

(74) Agent: DEVONS, David, Jon; Marks & Clerk, 57–60 Lincoln's Inn Fields, London WC2A 3LS (GB).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: ACTUATING AND LOCKING MECHANISM FOR A SURGICAL TOOL



(57) Abstract

An actuating mechanism for actuating a surgical tool of a surgical instrument comprises an actuating device having an actuator surface (21) whereby the actuating device is operable by applying a force to substantially any part (23) of the actuator surface (21) to place the actuating device in an actuated position (Figure 4) from a rest position (Figure 2) for actuating a surgical tool (not shown), wherein the actuator surface (21) comprises a radially collapsible cage having a plurality of interleaving actuating pads (23), each pad (23) being moveable in a radial direction.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

Actuating and Locking Mechanism for a Surgical Tool

The present invention relates to an actuating mechanism for actuating a surgical tool of a surgical instrument. It also relates to a locking mechanism for locking a surgical tool of a surgical instrument.

Minimal invasive surgery, known as key hole surgery, has become increasingly popular. The surgery involves making only a small incision in the patient and inserting a specifically designed implement through the incision. The implement comprises a miniaturised surgical implement such as forceps, clamps, scissors or diathermy hooks at the end of a long shaft with a handle attached to the other end for actuating the implement. The implement is inserted so that the handle is outside of the patient and, therefore the surgeon can operate on the patient through the small incision with minimal invasion. This type of surgery minimises the trauma experienced by the patient, reducing post-operation complications and improving patient's recovery time.

Conventionally, the handle of the implement is a scissors-type handle. It has been found that such a handle does not provide steady control and it is difficult to rotate the implement and therefore, it can not easily be manipulated by one hand.

This has been solved by providing a surgical instrument which is held in a pen-like grip. The handle of the instrument extends rearwardly between the surgeon's thumb and forefinger. The instrument can be rotated between the thumb and forefinger so that it can be manipulated easily by one hand and actuation of the tool at the other end of the instrument can easily be achieved by simply applying a force at a point along the handle between the thumb and forefinger.

A known type of instrument, which is held in a pen-like grip, is disclosed by WO 96/24298. The surgical instrument comprises a bulbous portion in which a plurality of discrete flexible actuating members are arranged around the circumference of the bulbous portion of the handle so that the user can depress any one of the actuator elements arranged around the circumference of the handle to actuate the surgical tool. However, it has been found that the bulbous portion of the handle is uncomfortable and the movement of the actuator elements to actuate the surgical tool requires a certain pressure to be applied to them to bring about actuation. This pressure has to be sufficient to overcome the resilience of the actuator members. This pressure can, in certain circumstances, be excessive making fine control of the surgical tool difficult. A further disadvantage is that the flexible actuating members tend to distort under pressure, so that the force output and movement of the instrument is irregular and unpredictable.

Furthermore, this known type of instrument has a mechanism of locking the tool in its actuated position. However, such a mechanism does not provide intermediatary positioning of the tool as is sometimes required.

Therefore, the present invention seeks to provide a mechanism which provides sensitive control of actuation of the surgical tool and which is comfortable when held in a pen-like grip. It also seeks to provide a mechanism for locking the surgical tool into a plurality of different actuated positions.

According to one aspect of the present invention, there is provided an actuating mechanism for actuating a surgical tool of a surgical instrument comprising an actuating device having an actuator surface whereby the actuating device is operable by applying a force to substantially any part of the actuator surface to place the actuating device in an actuated position from a rest position for actuating a surgical tool, wherein the actuator surface comprises a radially collapsible cage, having a plurality of interleaving actuating pads, each pad being movable in a radial direction.

In providing such an actuator surface, the handle of the surgical instrument is more like a pen which makes it more comfortable when held between the thumb and forefinger. The surface can be cylindrical and as such can be made to move an equidistance at any axial point along the surface. The shape of the actuator members of the prior art, however, means that the central portion has to be moved a greater distance by virtue of the bulbous shape and therefore the actuation of the device of the prior art is less sensitive. The pressure required to actuate the surgical tool by the actuator of the present invention is less and hence fine control of the surgical tool can be achieved.

Each pad may have an inwardly extending groove and the actuating device further comprising a plurality of radially extending guides, each guide engaging a respective inwardly extending groove of each pad so that each pad moves inwardly and outwardly in a radial direction. Preferably, the surgical tool is actuated by inward radial movement of the cage. The actuating mechanism may further comprise means for allowing each pad to move in unison. This may be in the form of a locking collar.

The rib cage provides an actuator surface which is more sensitive since its movement is not dependent on the resiliency of the actuator elements and therefore only a slight pressure needs to be applied to bring about actuation. The rib cage also provides a cylindrical surface which is more comfortable for the user and which is insensitive to radial orientation. Furthermore, the rib cage has a sufficiently rigid structure to resist both circumferential and axial distortion during use.

In a further preferred embodiment, the actuating mechanism comprises a locking mechanism for locking the actuating device in its actuated position. The actuating device may have a plurality of actuated positions and the locking mechanism is adapted to lock the actuating mechanism in any one of its actuated positions. The locking mechanism may further comprise release means for unlocking the actuating device from its actuated position into its rest position.

The actuating mechanism may further comprise override means for unlocking the actuating device from its actuated position to its rest position in an emergency such

as in the event of the effector becoming jammed by tissue in its closed position. The override means may be in the form of a manually operated push button.

In yet a further preferred embodiment, the actuating mechanism comprises biasing means for biasing the actuating device in its unactuated position. The biasing means may comprise a resilient means such as a compression spring.

According to a further aspect of the present invention, there is provided a locking mechanism for locking a surgical tool of a surgical instrument in its actuated position comprising interengaging means having a plurality of settings to lock the surgical tool in any one of a plurality of actuated positions.

The locking mechanism therefore provides means for setting the surgical tool in a number of different positions so that the tool can be locked at different degrees of actuation which provides accurate control of the instrument during surgery.

In a preferred embodiment, the interengaging means comprises latching means and actuator means wherein the latching means comprises a stepped surface and the actuator means has engaging means for interengaging any one of the steps of the stepped surface of the latching means to lock the actuator means in any one of a plurality of actuating positions. The engaging means of the actuating means may be in the form of at least one resilient arm having a projection at the remote end thereof to interengage a step of the stepped surface of the latching means. Alternatively, it may comprise a stepped surface, any one of the steps of the stepped surface of the actuator means interengaging any one of the steps of the stepped surface of the latching means. The depth of each step of the stepped surface of the actuator means may be greater than the depth of each step of the stepped surface of the latching means. In a preferred arrangement the depth of a step of the stepped surface of the latching means may be an exact multiple of the depth of a step of the stepped surface of the actuator means. The stepped surface or surfaces may be conical or spiral, having planar, cylindrical, pyramidal or polygonal shaped steps.

In a further preferred embodiment, the locking mechanism comprises release means for releasing the interengaging means form its locked position into an unlocked position.

The locking mechanism may further comprise override means for unlocking the interengaging means in an emergency such as the tool becoming jammed in its closed position and operation of the actuator is sufficient to release it. The override means may be a manually operated push button. The interengaging means may be biased in its unlocked position so that on release of the latching and actuator means, the surgical tool returns to its rest position.

According to a further aspect of the present invention, there is provided a surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising an actuating mechanism described above.

The actuating mechanism of the surgical instrument may be integral with the handle. Further, the diameter of the cylindrical surface defined by the actuator surface of the actuating mechanism may be approximately equal to the diameter of the handle.

The elongate shaft preferably comprises an actuator rod slideably mounted within an outer tube, the surgical tool being actuated by respective longitudinal movement between the actuator rod or the outer tube. The actuating device comprises means for translating the radial movement of the actuator surface into the longitudinal movement for actuating the surgical tool. The translation means may be in the form of a plurality of radius arms which extend in an axial direction upon application of the force to a part of the actuator surface.

According to a further aspect of the present invention, there is provided a surgical instrument comprising a handle, an elongate shaft extending from the handle and an effector mounted on the shaft at a location remote from the handle, the instrument further comprising a locking mechanism described above.

In a preferred embodiment, the elongate shaft comprises an actuator rod slideably mounted within an outer tube, the effector being actuated by respective longitudinal movement between the actuator rod or the outer tube, wherein the locking mechanism locks the actuator rod with respect to the outer tube in a plurality of longitudinal positions.

Preferably, the handle is elongate to enable it to be held in a pen-like grip. The surgical tool may comprise miniaturised forceps, clamps, scissors or diathermy hooks.

The embodiments of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a side elevation of the surgical instrument according to an embodiment of the present invention in the open position;

Figure 2 is a sectional view of the surgical instrument shown in Figure 1 in the open position;

Figure 3 is a sectional view of the actuating mechanism in the open position;

Figure 4 is a sectional view of the surgical instrument of the present invention in the fully closed position;

Figure 5 is a sectional view of the actuating mechanism of a present invention in the fully closed position;

Figure 6 shows the rib cage of the actuating mechanism of the surgical instrument of the present invention unfolded;

Figure 7a shows a sectional view taken along the line 7-7 of Figure 3 of the rib cage of the actuating mechanism of the present invention;

Figure 7b shows a sectional view taken along the line 7-7 of Figure 5 of the rib cage of the actuating mechanism of the present invention;

Figure 8 shows an alternative locking mechanism of the surgical instrument according to the present invention in its locked position; and

Figure 9 shows the alternative locking arrangement of Figure 8 in its locked position.

An embodiment of the present invention will now be described with reference to Figures 1 to 7b. The surgical instrument comprises an elongate handle 1 having a shaft 3 extending from one end thereof. A surgical tool or effector (not shown) is mounted at the distal end of the shaft 3. The shaft 3 is of a conventional construction and comprises a hollow outer tube 5 in which is slideably mounted an actuator rod 7. The surgical tool or effector, for example forceps, is actuated by the reciprocal movement of the actuator rod 7 within the outer tube 5.

The elongate handle 1 comprises an actuator portion 9 which, in use, is grasped between the thumb and forefinger and middle finger in a pen-like grip with the end portion 11 of the handle extending rearwardly between the thumb and forefinger. The actuator 9 comprises a nose portion 13, which has an outer wall 14a which is curved and tapers outwardly towards the end portion 11 of the handle. The nose portion 13 is fixed to the proximal end of the outer tube 5 of the shaft 3. The nose portion 13 has a blind-ended bore 14c coaxial to the longitudinal axis of the shaft 3. The inner wall 14b of the bore 14c tapers inwardly at a steeper angle than the taper of the outer wall 14a and then extends parallel to the longitudinal axis of the shaft 3 and handle 1 forming a cylindrical portion.

A latch 15 is slideably mounted within the bore 14c of the nose portion 13. The latch 15 has an outer wall 16a which is generally cylindrical at one end, the diameter of which is slightly less than the diameter of the cylindrical portion of the bore 14c of the

nose portion 13 so that there is a slight gap between the inner wall 14b of the bore 14c and the outer wall 16a of the latch 15. The outer wall 16a of the latch 15 then tapers outwardly from the cylindrical part of the latch 15 at the same angle as the inner wall 14b of the nose portion 13 such that the gap between the inner wall 14b of the nose portion 13 and the outer wall 16a of the latch 15 is maintained. The inner wall 16b of the latch 15 generally follows the shape of the outer wall 16a. The tapered portion of the inner wall 16b of the latch 15 has a plurality of fine cylindrical steps. The latch 15 extends rearwardly out of the nose portion 13 and has an outwardly extending flange 16c at the distal end thereof. The flange 16c extends outwardly beyond the outer wall 14a of the nose portion 13.

A cylindrical spacer 17 is provided along the cylindrical portion of the inner wall 16b of the latch 15. The spacer 17 is fixedly attached to the base of the bore 14c of the nose portion 13 and extends towards the end portion 11 of the handle beyond the distal end of the latch 15. The spacer 17 is stepped. The latch 15 is therefore sandwiched between the inner wall 14b of the nose portion 13 and the spacer 17 and is slideable therebetween. At the distal end of the spacer, there is located a plurality of radially extending finger pad guides 19. These are more clearly shown in Figures 7a and 7b. The diagrams show six finger pad guides, which are equispaced around the circumference of the outer tube 5 of the shaft 3. Of course, the number of finger pad guides can be varied as required. The finger pad guides 19 extend radially outwardly to slideably engage an inner groove 27 (described below) of a respective finger pad of the actuator 9.

The actuator portion 9 further comprises a rib cage 21, which consists of a plurality of interleaving finger pads 23. The outer surface 24a of the finger pads is curved so that when the finger pads 23 are linked together, they provide a substantially cylindrical surface around the shaft 3. The distal end of each finger pad 23 tapers inwardly at the same angle as the inner wall 16b of the latch 15. The outer surface 24b of the tapered portion is stepped. The depth of the steps of the finger pads 23 are greater than the depth of the steps of the latch 15. Any one step of the stepped surface 24b of each finger pad 23 interengages any one of the steps of the inner stepped surface 16b of

the latch 15. Each finger pad 23 further comprises an inwardly extending groove 27, which slideably engages a respective finger pad guide 19. At the midpoint of each finger pad 23, there is provided an inwardly extending protrusion 29 against which rests a plurality of radius arms 31, 33. The first radius arm 31 extends inwardly in a forward direction to rest against the forward edge 30a of the protrusion 29 of each finger pad 23 and the rearward edge 20a of its respective finger pad guide 19. The second radius arm 33 extends inwardly and rearwardly from the rearward edge 30b of the protrusion 29 of each finger pad 23 to rest against the forward edge 36a of a drive bush 35. The distal end of each finger pad 23 also tapers inwardly.

The end portion 11 of the handle 1 comprises a generally cylindrical body 37 in which is slideably fitted a thrust yoke 39. The body 37 has a stepped, inner bore 41 so that the inner diameter of the bore 41 of the body 37 increases towards the forward end of the body 37. The thrust yoke 39 is correspondingly stepped to conform to the shape of the bore 41 of the body 37. The shape of the thrust yoke 39 is such that a gap 43 is formed between the bore 41 of the body 37 and the thrust yoke 39. A compression spring 45 is located within the gap 43. The distal end of the thrust yoke 39 has a blind-ended bore 47 in which the actuator rod 7 of the shaft 3 is fixedly attached at one end thereof. The outer tube 5 has a mount 49. The outer tube 5 and mount 49 are slideable with respect to the actuator rod 7 and the bore 47 of the thrust yoke 39.

A generally cylindrical drive bush 35 rests against the forward end of the thrust yoke 39 and is slideable with respect to the outer tube 5 of the shaft 3 and the body 37. The drive bush 35 has an outwardly extending flange 36. An outer guide 51 is fixedly mounted to the forward end of the body 37 to rest against the flange 36 of the bush 35. The outer guide 51 has an inner cam surface 53. An inner guide 55 is fixedly attached within the outer guide 51 having an outer cam surface 55. The inner cam surface 53 of the outer guide 51 and the outer cam surface 57 of the inner guide 55 have a gap therebetween in which a straight T bar or ring 59 fixedly attached to the rearward tapered edge of each finger pad 23 is slideably engaged. The distal end of the thrust yoke 39 extends slightly from the distal end of the body 37 to form an override button 61.

The rib cage 21, in use, is covered with a rubber boot, not shown, to form a sealed unit so that the parts of the actuator portion 9 of the handle 1 is protected from the outside environment.

To actuate the tool, the rib cage 21 is compressed inwardly between the thumb and forefinger of the user from its open position, shown in Figures 2 and 3, into its closed position as shown in Figures 4 and 5. As a result of the interleaving arrangement of the finger pads 23, the rib cage 21 moves synchronously under compression and maintains its cylindrical shape. Compression of the rib cage 21 causes the radius arms 31 and 33 to slide the drive bush 35 and thus the thrust yoke 39 rearwardly. Hence the actuator rod 7 slides rearwardly with respect to the outer tube 5 of the shaft 3 against the bias of the compression spring. On compression of the rib cage 21 the inner groove of each finger pad 23 slides down its respective finger pad guide 19 as shown in Figure 7b and the distal end of each finger pad 23 moves inwardly and due to the stepped surfaces, the latch 15 slides rearwardly up the stepped surface of each finger pad 23 by action of the user's finger or by virtue of a spring and latches at a point along the stepped surface of each finger pad 23 to lock the implement in its actuated position. Since a plurality of steps are provided on each surface, the actuator rod 7 can be locked at a plurality of different longitudinal positions.

To release the surgical tool the latch 15 is moved axially in a forward direction by the user pressing his forefinger against the flange 16c of the latch 15. Each finger pad 23 is then released from the latch 15 and is free to move outwardly to its open, unlocked position along the cam surfaces of the inner and outer guides by the compression spring pushing against the thrust yoke 39. As a result the actuator rod 7 slides with respect to the outer tube 5 and hence release the tool at the end of the shaft 3. To help release the engaged step of the finger pads 23 from the latch 15, the rib cage 21 can be compressed slightly.

In the event that the effector or tool becomes jammed and can not be released by normal action of the device, the effector or tool can be actuated by depression of the

override button 61. The tool can then be released by manually pushing override button 61 to slide the thrust yoke 39 with respect to the body 37 which forces the actuator rod 7 to slide with respect to the outer tube 5 irrespective of the locking mechanism.

An alternative locking mechanism is shown in Figures 8 and 9. The figures illustrate the locking mechanism only, the actuator is not shown. The tool is actuated by sliding the actuator rod 7 with respect to the outer tube 5. It may be utilised in conjunction with the actuator described above or any other suitable actuator.

The handle 1 of the implement houses the actuator (not shown) and locking mechanism. The handle 1 comprises a body 63 having a stepped, inner bore 65. The actuator rod 7 extends through the bore 65 and has an enlarged portion 67 at the distal end thereof. The enlarged portion 67 extends slightly out of the inner bore 65 of the body 63.

The locking mechanism is housed within the enlarged portion of the bore 65 of the body 63. It comprises an upper portion 71, which is fixedly attached to the actuator rod 7 toward the distal end thereof. The upper portion 71 of the lock has a generally cylindrical body with a central bore through which the actuator rod 7 passes. The forward end of the upper portion 71 of the lock comprises a stepped, spiral surface 73. A locking ring 75 is attached to the distal end of the outer tube 5 so that the locking ring 75 can rotate about its axis with respect to the outer tube 5. The locking ring 75 has a complementary stepped spiral surface 77 facing the stepped spiral 73 of the upper portion 71. The locking ring 75 has a pair of diametrically opposing, outwardly extending projections 79. A torsion spring 81 is fixedly attached to one end of the locking ring 75 and the other to the outer tube 5 of the shaft 3 to bias the locking ring rotationally on the axis of the shaft 3.

The locking mechanism also comprises a release ring 83. The release ring 83 is slideable with respect to the shaft 3 and body 63 of the handle 1. The release ring 83 comprises an outer ring portion 85, which has a diameter greater than the diameter of the body of the handle 1. The forward end of the ring portion 85 extends outwardly to a

flange 87. The release ring 83 further comprises an inner ring portion 89, which has a diameter less than the diameter of the bore of the body. The proximal end of the inner ring portion 89 provides a spiral cam surface 91.

The locking mechanism operates to lock the actuator rod 7 in a predetermined position with respect to the outer tube 5 by engagement of the complementary stepped surfaces 73,77 of the upper portion 71 and the locking ring 75. To actuate the tool (mechanism not shown), the actuator rod 7 is caused to slide in a rearward direction with respect to the outer tube 5. As a result the upper portion 71 moves rearwardly with the actuator rod 7. This releases the engagement of the steps and the locking ring 75 can rotate about its axis by virtue of the torsion spring so that the spiral surfaces 73, 77 of the upper portion 71 and the locking ring 75 remain in contact. The inner ring portion 89 of the release ring 83 slides into the bore 65 of the body 63 until the cam surface 91 of the inner ring portion 89 rests on one of the projections 79. To release the actuator rod 7, the outer ring portion 85 is forced to slide axially in a forward direction by the user between their thumb and forefinger. Due to the cam surface 91 running against the projections 79, the locking ring is caused to rotate against the bias of the torsion spring. This causes the locking ring to be released and allows the upper portion 71 to move axially in a forward direction as the stepped surface 73 follows that of the locking ring 75, hence unlocking the device.

The locking mechanism described above and that of the first embodiment can be utilised in conjunction with any known type of actuating mechanism. The stepped surfaces of the locking mechanisms enable the surgical tool to be held in a plurality of settings. Further the actuating mechanism described above can be incorporated with any known type of locking mechanism.

In the light of this disclosure, modifications of the described embodiments as well as other embodiments, all within the scope of the appended claims, will now become apparent to a person skilled in the art.

Claims:

1. An actuating mechanism for actuating a surgical tool of a surgical instrument comprising an actuating device having an actuator surface whereby the actuating device is operable by applying a force to substantially any part of the actuator surface for placing the actuating device in an actuated position from a rest position for actuating a surgical tool, wherein the actuator surface comprises a radially collapsible cage having a plurality of interleaving actuating pads, each pad being movable in a radial direction.

2. An actuating mechanism according to claim 1, wherein each pad has an inwardly extending groove and the actuating device further comprises a plurality of radially extending guides, each guide engaging a respective inwardly extending groove of each pad so that each pad is capable of inward and outward movement in a radial direction.

3. An actuating mechanism according to claim 1 or 2, wherein the cage is adapted such that inward radial movement of the cage causes the actuating device to be placed into its actuated position.

4. An actuating mechanism according to any one of the preceding claims, wherein the actuating mechanism further comprises a locking mechanism for locking the actuating device in its actuated position.

5. An actuating mechanism according to claim 4, wherein the actuating device has a plurality of actuated positions and the locking mechanism is adapted to lock the actuating device in any one of its actuated positions.

6. An actuating mechanism according to claim 4 or 5, wherein the locking mechanism further comprises release means for unlocking the actuating device from its actuated position into its rest position.

7. An actuating mechanism according to any one of claims 4 to 6, wherein the actuating mechanism further comprises override means for returning the actuating device from its actuated position to its rest position in the event of the surgical tool becoming jammed.

8. An actuating mechanism according to any one of the preceding claims, wherein the actuating mechanism further comprises biasing means for biasing the actuating device in its rest position.

9. An actuating mechanism according to claim 8, wherein the biasing means comprises a compression spring.

10. An actuating mechanism for actuating a surgical tool of a surgical instrument substantially as hereinbefore described with reference to any one of the accompanying drawings.

11. A locking mechanism for locking a surgical tool of a surgical instrument in its actuated position comprising interengaging means having a plurality of settings to lock the surgical tool in any one of a plurality of actuated positions.

12. A locking mechanism according to claim 11, wherein the interengaging means comprises latching means and actuator means wherein the latching means comprises a first stepped surface and the actuator means comprises engaging means, the engaging means interengaging any one of the steps of the first stepped surface of the latching means to lock the actuator means in any one of a plurality of actuated positions.

13. A locking mechanism according to claim 12, wherein the engaging means of the actuator means comprises a second stepped surface, any one of the steps of the second stepped surface of the actuator means interengaging any one of the steps of the first stepped surface of the latching means.

14. A locking mechanism according to claim 13, wherein the depth of each step of the second stepped surface of the actuator means is greater than the depth of each step of the first stepped surface of the latching means.

15. A locking mechanism according to any one of claims 12 to 14, wherein the stepped surface or surfaces are conical.

16. A locking mechanism according to any one of claims 12 to 14, wherein the stepped surface or surfaces are spiral.

17. A locking mechanism according to any one of claims 11 to 16, wherein the locking mechanism further comprises release means for releasing the interengaging means form its locked position into an unlocked position.

18. A locking mechanism according to claim 17, wherein the locking mechanism further comprises biasing means for biasing the interengaging means in its unlocked position.

19. A locking mechanism for locking a surgical tool of a surgical instrument substantially as hereinbefore described with reference to any one of the accompanying drawings.

20. A surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising an actuating mechanism according to any one of claims 1 to 11.

21. A surgical instrument according to claim 20, wherein the actuating mechanism is integral with the handle.

22. A surgical instrument according to claim 21, wherein the diameter of the cylindrical surface defined by the actuator surface of the actuating device is approximately equal to the diameter of the handle.

23. A surgical instrument according to any one of claims 20 to 22, wherein the elongate shaft comprises an actuator rod slideably mounted within an outer tube, the actuating device actuating the surgical tool by respective longitudinal movement between the actuator rod and the outer tube.

24. A surgical instrument according to claim 23, wherein the actuating device further comprises means for translating the radial movement of the actuator surface into longitudinal movement for actuating the surgical tool.

25. A surgical instrument according to claim 24, wherein the translation means comprises a plurality of radius arms which extend in an axial direction upon application of the force to a circumferential part of the actuator surface.

26. A surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising a locking mechanism according to any one of claims 11 to 19.

27. A surgical instrument according to claim 26, wherein the elongate shaft comprises an actuator rod slideably mounted within an outer tube, the surgical tool being actuated by respective longitudinal movement between the actuator rod and the outer tube.

28. A surgical instrument according to claim 27, wherein the locking mechanism locks the actuator rod with respect to the outer tube in a plurality of longitudinal positions.

29. A surgical instrument according to any one of claims 20 to 28, wherein the handle is elongate to enable it to be held in a pen-like grip.

30. A surgical instrument according to any one of claims 20 to 29, wherein the surgical tool comprises miniaturised forceps, clamps, scissors or diathermy hooks.

31. A surgical instrument substantially as hereinbefore described with reference to any one of the accompanying drawings.

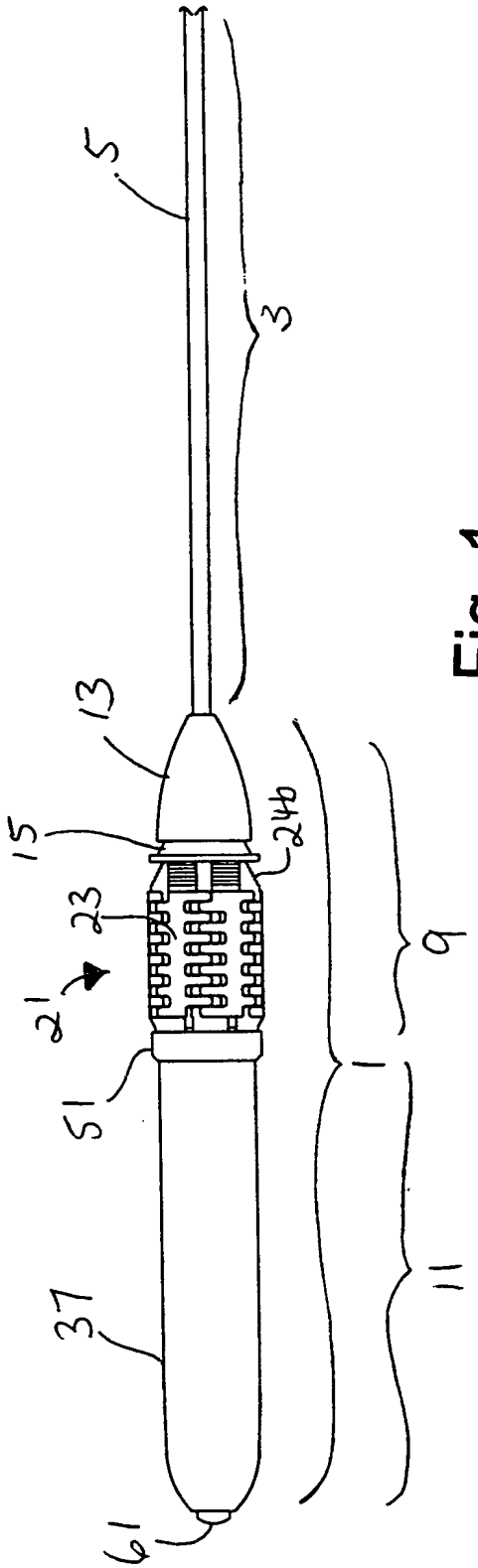


Fig. 1

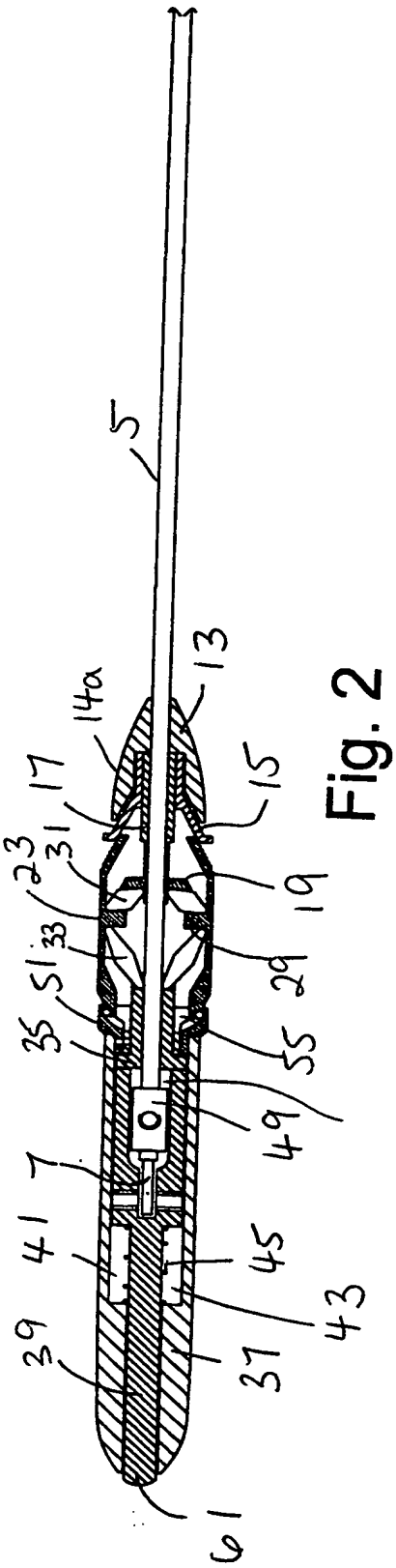

5
13
14a
17
15
23
31
19
33
51
29
35
55
49
7
41
45
39
43
37
61

Fig. 2

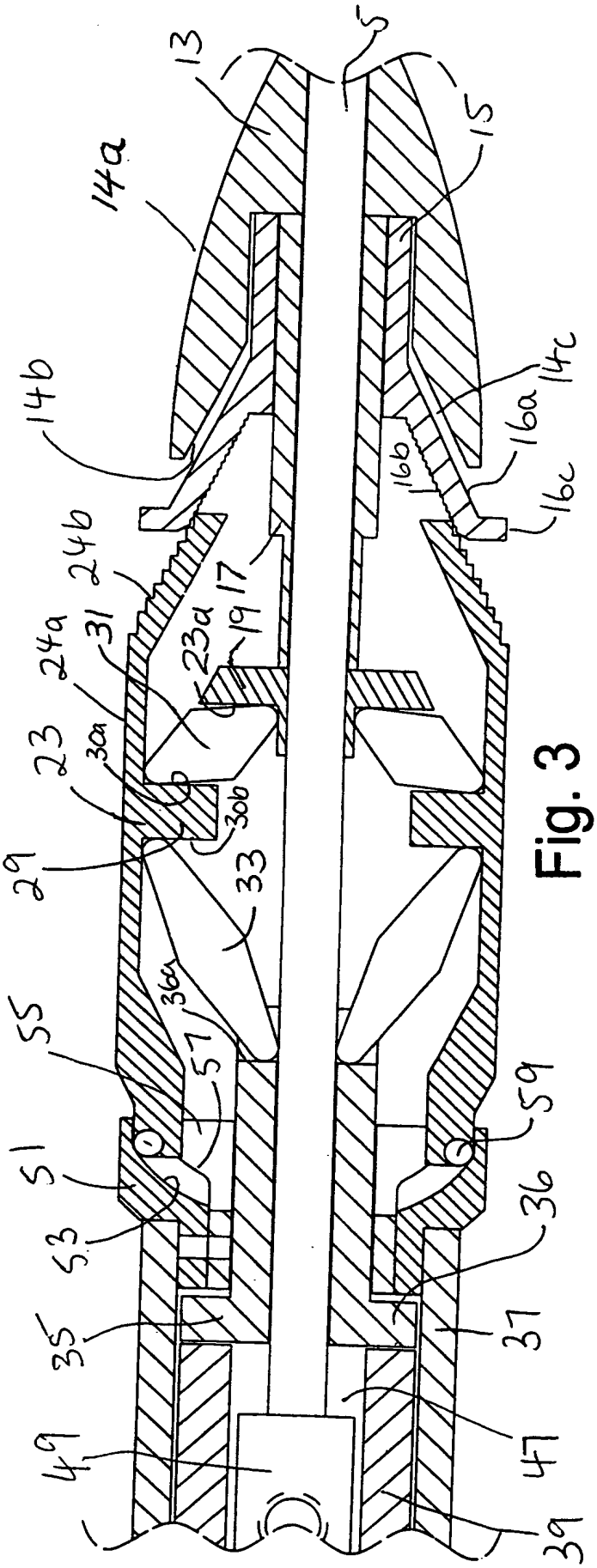

5
13
15
14a
14b
14c
16a
16b
16c
24b
17
31
24a
19
23d
23
30a
30b
29
33
55
36a
57
59
51
53
36
35
37
49
47
39

Fig. 3

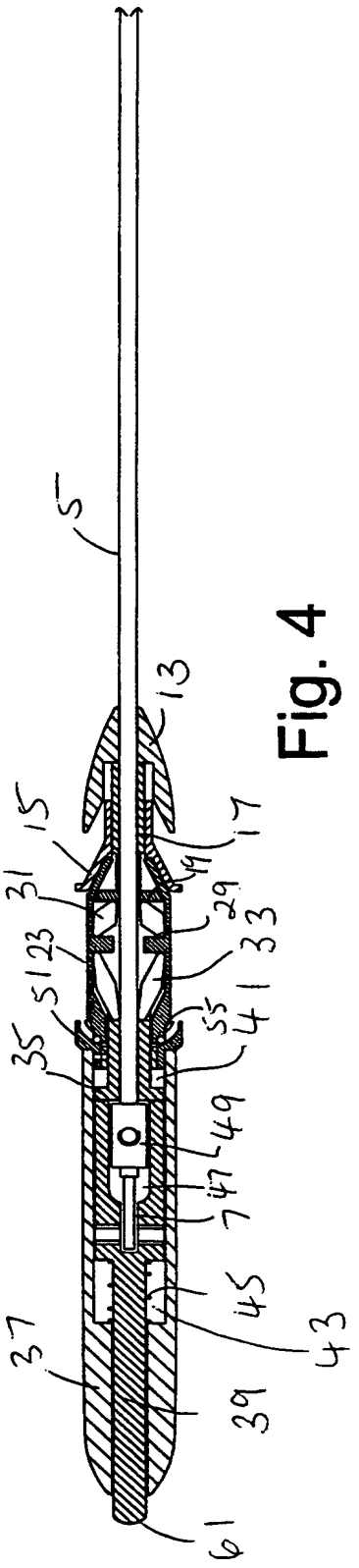

5
13
15
17
19
29
31
33
35
37
39
41
43
45
47
49
51
53
55
61

Fig. 4

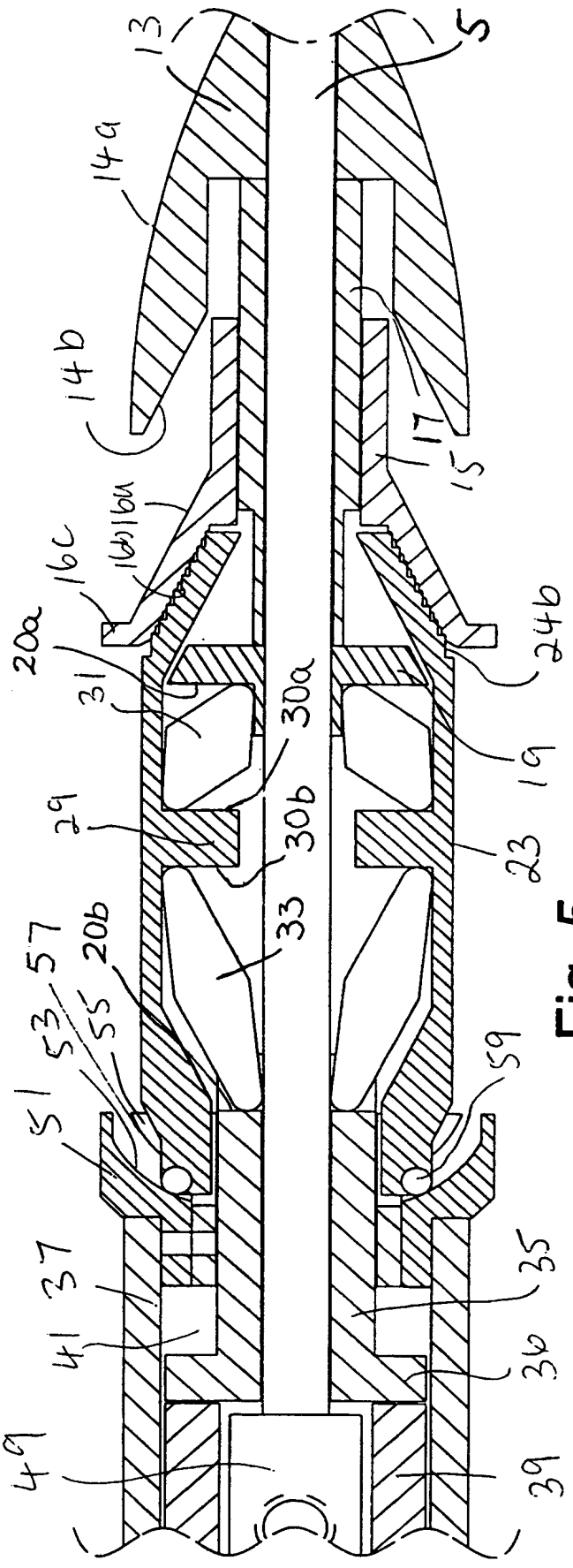

5
13
14a
14b
15
16a
16b
16c
17
19
20a
20b
23
24b
29
30a
30b
31
33
35
36
37
39
41
49
51
53
55
57
59

Fig. 5

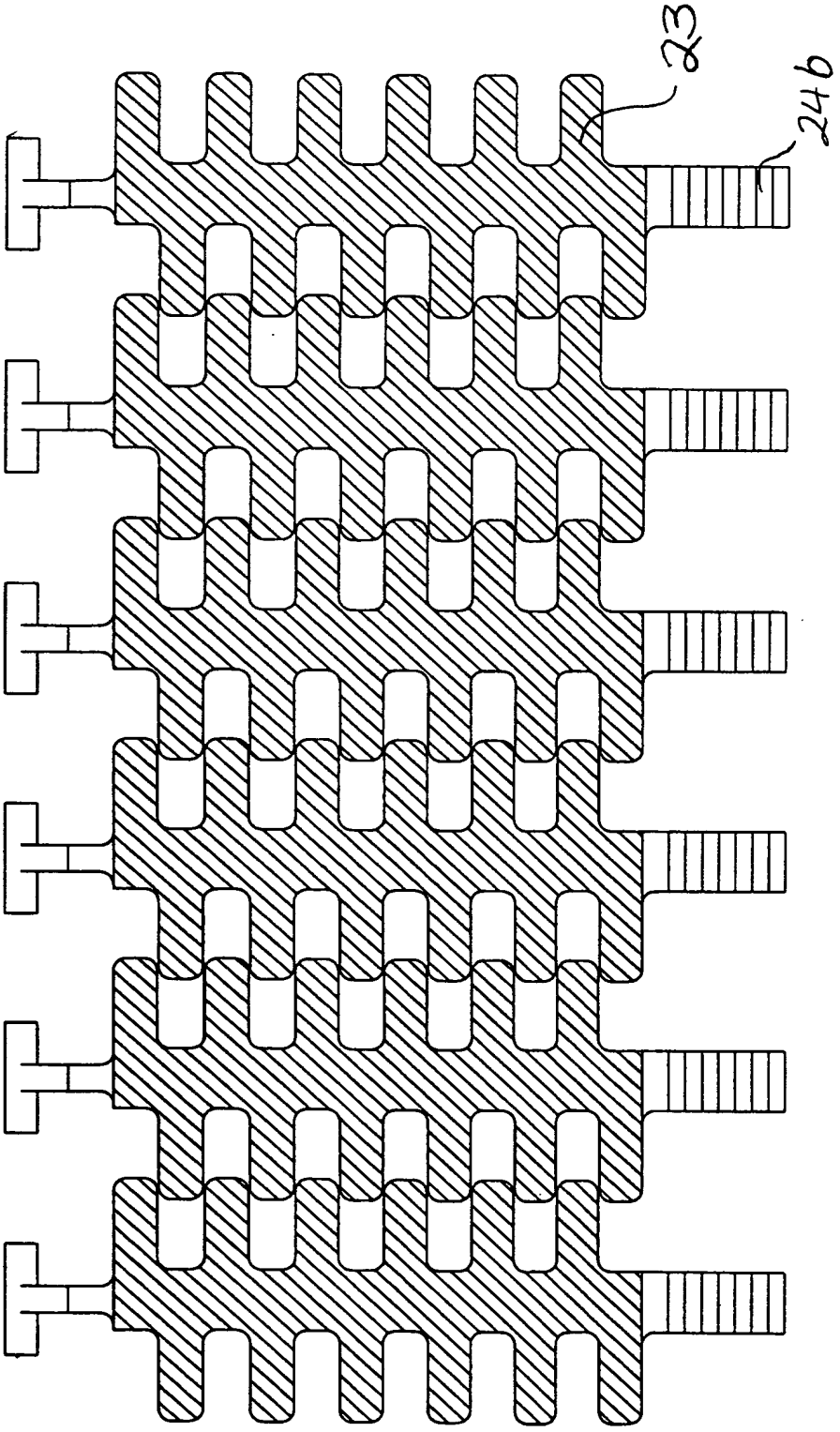


Fig. 6

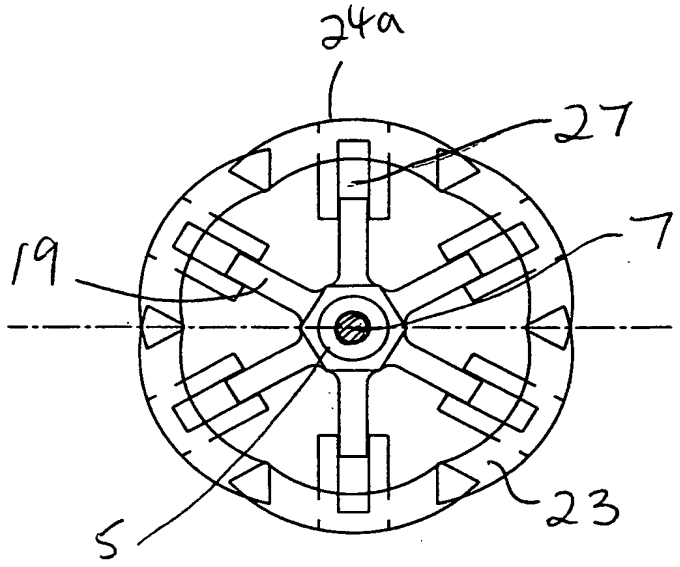


Fig. 7a

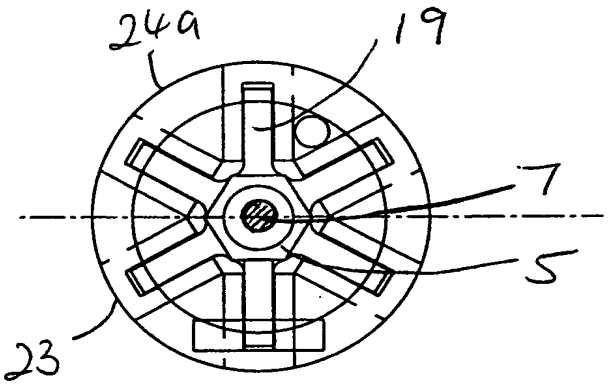


Fig. 7b

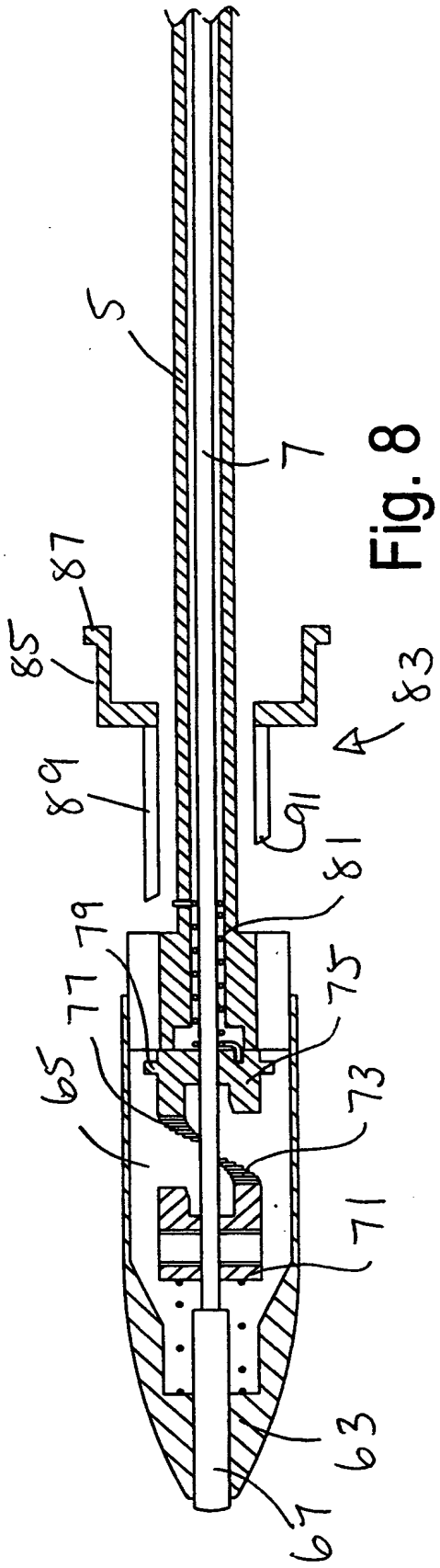

5
7
87
85
89
83
91
81
79
77
75
65
73
71
63
67

Fig. 8

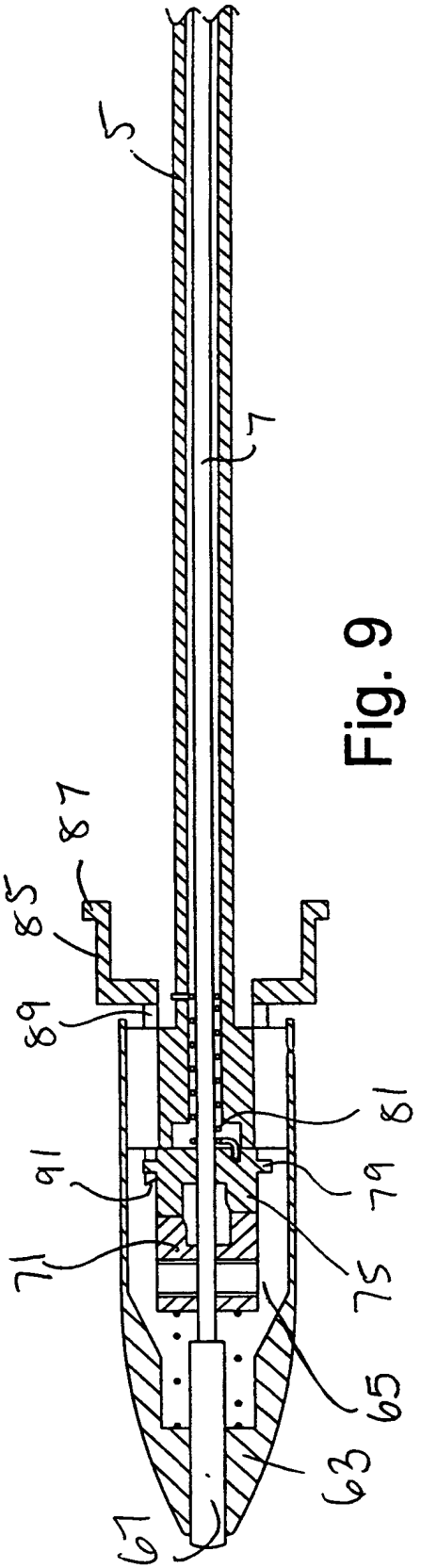

5
7
87
85
89
91
81
79
71
75
65
63
67

Fig. 9

INTERNATIONAL SEARCH REPORT

Inter: nal Application No
PCT/GB 00/00325

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B17/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 701 832 A (BLUET JEAN LUC ;LECLERC YVES) 2 September 1994 (1994-09-02) page 3, line 23 -page 4, line 28; figures 1,2	11-13, 17-19, 26-28,30
Y		29
Y	WO 96 24298 A (DEVLIN STUART LESLIE ;DAMPNEY IAN TREVOR (GB)) 15 August 1996 (1996-08-15) cited in the application abstract page 5, paragraph 5 figure 1	29
A		1-3, 8-10,20, 21,23, 24,31

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 May 2000	12/05/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Ducreau, F

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Intern. nal Application No
PCT/GB 00/00325

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 653 729 A (CHAPPUIS MICHAEL C ET AL) 5 August 1997 (1997-08-05) column 1, line 55 -column 2, line 3; figures 1-4	11,17, 19,26
A	DE 35 26 821 A (HENSLER EWALD) 5 February 1987 (1987-02-05) the whole document	1-3, 8-10, 20-24,31
A	US 5 355 871 A (HURLEY PAUL ET AL) 18 October 1994 (1994-10-18) the whole document	1-3, 8-10,20, 21,23, 24,31
A	US 4 760 848 A (HASSON HARRITH M) 2 August 1988 (1988-08-02) abstract; figures 1,4	1-3, 8-10, 20-24,31
A	US 5 715 604 A (LANZONI MAURICE) 10 February 1998 (1998-02-10) abstract; figures 2,4,5	11,17, 19,26

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. nal Application No
PCT/GB 00/00325

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
FR 2701832	A	02-09-1994	NONE		
WO 9624298	A	15-08-1996	AU	4492396 A	27-08-1996
			EP	0808133 A	26-11-1997
US 5653729	A	05-08-1997	US	5876420 A	02-03-1999
DE 3526821	A	05-02-1987	NONE		
US 5355871	A	18-10-1994	NONE		
US 4760848	A	02-08-1988	NONE		
US 5715604	A	10-02-1998	FR	2735350 A	20-12-1996
			EP	0748614 A	18-12-1996

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
A61B 17/28, 17/39, 17/36

A1

(11) International Publication Number: **WO 96/24298**

(43) International Publication Date: 15 August 1996 (15.08.96)

(21) International Application Number: PCT/GB96/00161

(22) International Filing Date: 25 January 1996 (25.01.96)

(30) Priority Data:
9502498.0 9 February 1995 (09.02.95) GB

(71)(72) Applicant and Inventor: DEVLIN, Stuart, Leslie [GB/GB]; Southbourne Court, Copsale, West Sussex RH13 7DJ (GB).

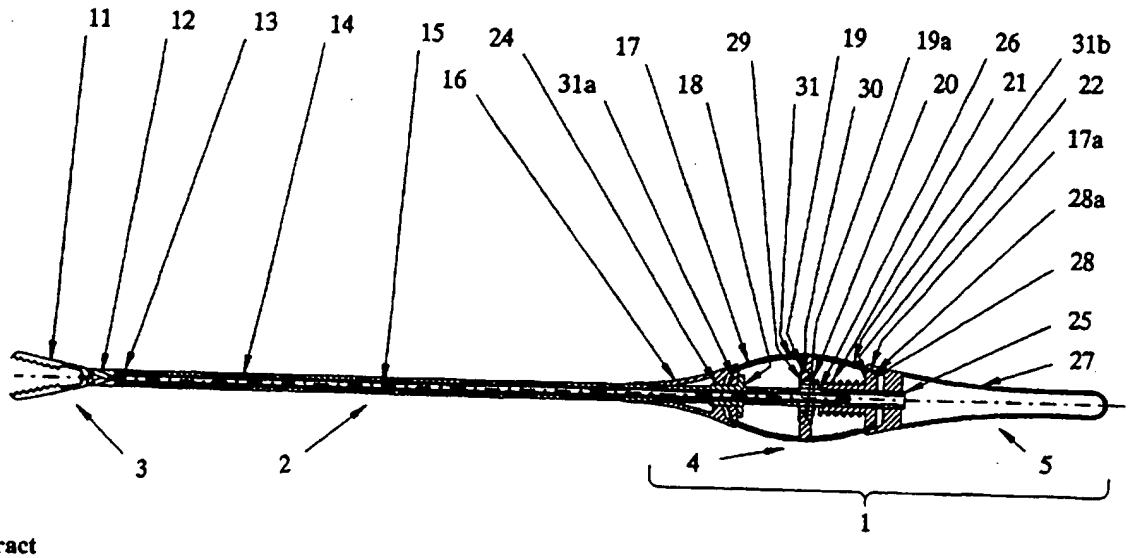
(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: DAMPNEY, Ian, Trevor [GB/GB]; 20 Stile Hall Gardens, Chiswick, London W4 3BU (GB).

(74) Agents: HUTCHINS, Michael, Richard et al.; Fry Heath & Spence, The Old College, 53 High Street, Horley, Surrey RH6 7BN (GB).

(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AZ, BY, KG, KZ, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: SURGICAL INSTRUMENTS



(57) Abstract

The invention provides a surgical instrument comprising a handle (1) shaped to enable it to be freely rotated by the user's fingers about its longitudinally axis in the hand of the user, and held by the user at any angle of rotation about its longitudinal axis;the handle (1) having an elongate shaft (2) extending therefrom and a surgical tool (3) mounted on the shaft (2) at a location remote from the handle (1); the handle (1) being provided with actuato means (20, 15, 29) operatively linked through the shaft (2) to the surgical tool (3); the actuator means having an actuator surface (17, 31) or surfaces extending around substantially the entire circumference of the handle (1), whereby the actuator means is operable by applying pressure at substantially any circumferential location on the actuator surface (17, 31) or surfaces, to actuate the surgical tool (3). The surgical instrument is designed particularly to be held in a pen-like grip, rather than in the palmof the hand or in a scissors grip as is conventional, and is desined to be actuated from any rotated position.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia
AT	Austria
AU	Australia
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CS	Czechoslovakia
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgystan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakhstan
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
MX	Mexico
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
SN	Senegal
SZ	Swaziland
TD	Chad
TG	Togo
TJ	Tajikistan
TT	Trinidad and Tobago
UA	Ukraine
UG	Uganda
US	United States of America
UZ	Uzbekistan
VN	Viet Nam

SURGICAL INSTRUMENTS

This invention relates to surgical instruments, for use in laparoscopic or endoscopic surgery and/or open surgery.

Laparoscopic and endoscopic surgical methods have become increasingly popular in recent years. Such methods typically involve making small incisions in the abdominal wall of a patient through which specially designed laparoscopic or endoscopic tools are inserted for carrying out the surgical procedure. Such tools typically have a miniaturised surgical implement such as forceps or scissors at the end of a long shaft to the other end of which is attached a handle and actuating mechanism. By the use of such tools, the surgeon can operate the instrument from outside the patient's body whilst monitoring the movement of the surgical tool within the body by means of an endoscope.

Such techniques of minimally invasive therapy (MIT), which have been commonly referred to as keyhole surgery, offer very substantial advantages over conventional open surgery in that only very small incisions in the patient's body wall are required thus substantially minimising patient trauma, dramatically reducing post-operative complications, and greatly reducing the patient's recovery time.

As laparoscopic or endoscopic surgical techniques are generally more delicate than those of open surgery, the surgical instruments need to be

particularly easy to manipulate and use. Hitherto, the surgical instruments used in MIT have been cumbersome to use. For example, many conventional laparoscopic instruments have off-centre scissor handles for actuating the surgical tool. The presence of such scissor-handle actuated mechanisms makes steady control and rotation of the instrument difficult. To overcome this problem, some tools are provided with a thumb wheel by which the actuator shaft is rotated independently from the scissor handles. However, such an arrangement is clumsy to use and often requires two hands to operate effectively. Thus, there remains a need for surgical instruments for use in surgery which are more easily manipulated, can be operated entirely by one hand, can be rotated freely, and operated just as effectively in any rotated position to enable the orientation of the surgical tool to be varied as required. It is an object of the present invention to provide such an instrument.

The present invention is based in part on the recognition that a surgical instrument can be manipulated with greater control and sensitivity when the instrument is held in a pen-like grip, i.e. with the non-functioning end of the instrument extending rearwardly from between the thumb and forefinger. Furthermore, the invention is based on the recognition that a surgical instrument can be made more responsive and easier to use if it can be rotated by the fingers to any position and can be actuated from a position anywhere around the circumference of the handle of the instrument. This is in contrast to existing surgical tools such as those disclosed in, for example EP-A-0535370 and EP-A-0598202, in which either a squeeze grip type actuation mechanism is provided, or an actuator lever is provided at a single location on the circumference of the instrument handle.

Accordingly, in a first aspect the invention provides a surgical instrument comprising a handle shaped to enable it to be freely rotated by the user's fingers about its longitudinal axis in the hand of the user, and

held by the user at any angle of rotation about its longitudinal axis; the handle having an elongate shaft extending therefrom and a surgical tool mounted on the shaft at a location remote from the handle; the handle being provided with actuator means operatively linked through the shaft to the surgical tool; the actuator means having an actuator surface or surfaces extending around substantially the entire circumference of the handle, whereby the actuator means is operable by applying pressure at substantially any circumferential location on the actuator surface or surfaces, to actuate the surgical tool.

The handle may be of generally circular cross-section, or it may be of a non-circular cross-section. For example it may be of polygonal cross-section, eg hexagonal or octagonal, but most preferably it is circular in cross-section. The term circumference as used herein is intended to refer to the perimeters of both circular and non-circular handles.

The actuator surface may be a continuous surface extending around the circumference of the handle or it may, alternatively, comprise an array of closely spaced discrete actuator elements.

The actuator means may be mechanical, electrical, pneumatic or hydraulic or any combination of these.

In one particular example of a mechanical arrangement, the actuator means is mechanically linked to an actuating rod disposed slidably within the elongate shaft, which rod is in turn linked to the surgical tool on the end of the shaft.

In one particular example of an electrical arrangement, the actuator means may comprise a switch or array of switches for controlling the flow of electrical current along the shaft to a diathermy tool (e.g. a diathermy hook) at the end thereof.

The surgical tool mounted at the end of the elongate shaft may be any one of the types of surgical tools conventionally used in laparoscopic or endoscopic surgery. Thus, for example, the surgical tool may be a miniaturised surgical instrument such as a pair of forceps, a clamp, a pair of scissors or a diathermy hook. Any of the aforesaid tools may optionally have a monopolar or bipolar diathermy capability.

The actuator means in one embodiment can be an array of radially displaceable actuator elements disposed around the circumference of the handle, means being provided for converting radial inward movement of an actuator element into longitudinal movement of the actuating rod within the elongate shaft.

For example, the actuator element may be provided with an edge or surface which functions as a cam follower or camming surface, for engaging and camming against a complimentary camming surface or cam follower associated with the actuating rod.

In one embodiment, each actuator element is provided with a wedging member having an inclined surface whereby radially inward movement of the actuator element urges the inclined surface of the wedging member into contact with a camming edge or surface associated with the actuator shaft, thereby to displace the camming edge or surface in a longitudinal direction.

A sufficiently large number of actuator elements are disposed around the circumference of the handle to ensure that the instrument can be actuated from substantially any location around its circumference. For this purpose, a minimum of three actuator elements is generally required, but preferably there are more than three actuator elements disposed around the circumference, more preferably there are at least six actuator elements, and in one particularly preferred embodiment there are eight actuator elements. In another particularly preferred embodiment, there are twelve

actuator elements.

The handle is preferably of elongate form and is sufficiently small in cross section to enable it to be held in a pen-like grip, i.e. wherein the end of the handle remote from the actuator shaft extends away from the hand between the thumb and adjacent finger.

The handle may typically have a bulbous shape, being tapered towards the end remote from the surgical tool, increasing in diameter towards the central portion thereof and tapering again towards the actuator shaft. The actuator means typically is located within the bulbous or enlarged diameter central region of the handle.

The handle may be provided with means for effecting locking of the surgical tool in a given configuration. For example, where the surgical tool is in the form of a miniature pair of grasping forceps or a clamping tool, the locking means may be effective to lock the forceps or clamping tool in a clamping or gripping configuration.

In one embodiment, the handle is provided with first actuator means for effecting movement of a surgical tool at the end of the actuator shaft from a rest position to an actuated position; locking means for locking the surgical tool in the actuated position; and second actuator means operable to release the locking means to enable the surgical tool to return to the rest position.

Where the actuator means is mechanically linked to an actuating rod disposed slidably within the elongate shaft, which rod is in turn linked to the surgical tool on the end of the shaft, the locking means can take the form of a grasping member having a plurality of grasping portions which grasp the actuating rod to lock it in an actuated position, the second actuator means being operable to force the said grasping portions apart to

release the grip on the actuating rod.

The actuating rod may be provided with a spiral track (e.g. a thread) or an array of annular ridges, which cooperate with the grasping portions to form a ratchet mechanism, the spiral track (e.g. thread) being preferred because many more grasping positions are possible within the same linear movement of the actuating rod.

The second actuator means is preferably arranged to be actuable from substantially any position around the circumference of the handle.

The advantages of the surgical instruments of the present invention reside in their ease of manipulation and lightness, and in particular in the ease with which the surgical tool can be rotated and actuated at any rotated position. The ability of the surgical instruments of the invention to be held in a pen-like grip, rather than in the palm of the hand, or in a scissors grip as is conventionally the case, and to be actuated from any rotated position, means that the tool can be operated with much greater sensitivity thereby enabling surgical procedures to be carried out more accurately, safely, efficiently and with reduced surgeon fatigue.

In another aspect, the invention provides an actuator device comprising an actuating rod movable in a reciprocating manner along an axis, the actuating rod having a grasping region defined by a length of the rod having a spiral track (eg a thread) at the surface thereof; biasing means for resiliently biasing the actuating rod in a first direction; actuator means for moving the actuating rod in a second direction opposite to the first direction against a restoring force of the biasing means; grasping means comprising a plurality of grasping portions for grasping the actuating rod at the grasping region to hold the rod in an actuated position against the said restoring force; and grasp releasing means for releasing

the actuating rod from the grasping means.

The plurality of grasping portions typically takes the form of an annular array of radially inwardly directed grasping fingers formed from a resilient material (e.g. a metal disc spring); the clearance between the radially innermost edges of opposing grasping fingers being less than the diameter of the actuating rod; such that as the actuating rod is urged through the grasping means in one direction, the grasping fingers engage the spiral track at the surface of the actuating rod to prevent movement of the actuating rod in the reverse direction.

The grasp releasing means can take the form of a grasp releasing member having a conical or frustoconical surface which can be urged in an axial direction against the grasping fingers to lift them away from the spiral track to release the actuating rod.

The actuator device is particularly useful in the context of the surgical instruments of the present invention, but may well find uses in other technical fields.

The invention will now be illustrated but not limited, by reference to the specific embodiments shown in the accompanying drawings, of which:-

Figure 1 is a side sectional elevation of a surgical instrument according to one embodiment of the invention;

Figure 2 is a side elevation of the embodiment shown in Figure 1;

Figure 3 is a side sectional elevation of the handle portion of a surgical instrument according to a second embodiment of the invention;

Figure 4 is a partial sectional elevation of a surgical instrument according to a third embodiment of the invention;

Figure 5 is an isometric view of a component of the instrument shown in Figure 4;

Figure 6 is an isometric view of the grasping mechanism of the instrument shown in Figure 4;

Figures 7a and 7b are enlarged elevations of actuating wedges and grasp releasing wedges respectively used in the instrument of Figure 4;

Figure 8 is a partial sectional elevation of an instrument according to a fourth embodiment of the invention;

Figure 9 is a partial sectional elevation of an instrument according to a fifth embodiment of the invention;

Figure 10 is an enlarged cross-section of a component of the instrument shown in Figure 9;

Figure 11 is a partial sectional elevation of a surgical instrument according to a sixth embodiment of the invention; and

Figure 12 is an enlarged view of part of the surgical instrument shown in Figure 11.

Referring now to Figures 1 and 2 it can be seen that the surgical instrument according to one embodiment of the invention comprises an elongate handle 1 having a shaft 2 extending from one end thereof, and a surgical tool 3 mounted at the distal end of the shaft 2. The handle 1 in this embodiment is of elongate form and has a bulbous region 4 from which

extends the shaft 2, and a tapering handle extension 5. In use, the tool is grasped between thumb, forefinger and the middle finger, as one would grip a pen, with the end 5 of the instrument extending rearwardly between the thumb and forefinger. The bulbous region 4 conceals an actuator assembly, the details of which can be seen in Figure 1.

Referring now to Figure 1, it can be seen that the elongate shaft 2 comprises an outer effector tube 14 having slidably disposed within the hollow interior thereof an actuating rod 15. A surgical tool housing 13 is mounted in the end of effector tube 14, e.g. by silver soldering, a pair of forceps jaws 11 being pivotably mounted on the tool housing 13. The forceps jaws 11 are linked via forceps linkage 12 to the distal end of the actuating rod 15.

The other end of the effector tube 14 extends into and through the bulbous region 4 of the handle 1. The effector tube 14 is provided with a radial flange 18 with an external thread 24 which mates with the internal thread of the generally conical junction member 16. The proximal end 25 of the effector tube is also provided with an external thread upon which is mounted the pen-handle tail-piece 27. The portion of the effector tube 14 passing through the bulbous region 4 of the handle 1 is provided with a slot 26 which allows a cam wheel actuator 20 to be fixedly mounted on the actuating rod 15, the slot 26 having a sufficiently large axial dimension to enable the cam wheel actuator 20 to slide forward and backwards in a reciprocal manner in the slot. Attached to the outer surface of the effector tube 14, to the rear of the slot 26, is an annular collar 22 which has a radial flange 28 extending from the rear part thereof. A return spring 21 is mounted on the annular collar 22 and abuts against the flange 28 and the cam wheel actuator 20 so as to bias the cam wheel actuator 20 towards the front of the slot 26.

Cam wheel actuator 20 has a plurality of inclined surfaces 29 around

its outer circumference, each inclined surface 29 being separated from an adjacent inclined surface by means of a pair of axially aligned dividing walls 30.

Disposed radially outwardly of the cam wheel actuator 20 is an array of actuating fingers 19 each of which has an inclined camming surface 19a complementary to the inclined surfaces 29 of the cam wheel actuator. The actuating fingers 19 are mounted on generally flexible actuating arms 31 which have a generally arcuate profile in cross-section and which are joined together at the distal end of the bulbous region 4 and secured to the effector tube 14 by clamping between the conical junction member 16 and the flange 18. Thus, each actuating arm 31 is radially connected to a common hub 31a which is of thicker cross-section than the arcuate portion, the thicker hub 31a resting in front of flange 18. Disposed around the outside of the array of actuator arms 31 is a flexible skin or boot 17 which encases the inner workings of the actuation mechanism. The boot 17, which may be formed from an appropriately flexible plastics material, has an in-turned end portion which, together with hub 31a, is clamped against flange 18 by screwing the threaded junction member 16 tightly onto the external thread 24 of the radial flange 18.

The other end 31b of each actuator arm 31 is unsecured, but the end 17a of the boot 17 is clamped between the outer inclined surface 28a of flange 28 and the inner surface of the handle extension piece 5 as the handle extension piece 5 is screwed onto the threaded end 25 of the effector tube 14.

In use, in order to cause the jaws of the forceps to close, the user of the instrument depresses any one or more of the actuator arms 31 thereby to urge the actuating finger 19 towards the cam wheel actuator. As the actuating finger 19 comes into contact with the cam wheel actuator, the inclined camming surface 19a of the actuating finger cams along the

inclined surface 29 of the cam wheel actuator thereby forcing the actuator wheel to move rearwardly along the slot 26. Since the cam wheel actuator is fixed to the actuating rod 15, this has the effect of moving the rod 15 in a rearwards direction thereby causing the jaws of the forceps to close.

Once the pressure is released on the actuating arms 31, the force of the return spring 21 urges the cam wheel actuator forwardly back along the slot to its rest position, thereby causing the actuating rod 15 to move forwardly with it, and thus opening the jaws of the forceps.

The embodiment of the invention illustrated in Figures 1 and 2 can be formed from a combination of materials. Thus, normally the forceps jaws 11, forceps linkage 12, linkage housing 13, effector tube 14 and actuating rod 15 would be formed of surgical quality stainless steel but they need not be; instead other metals or an appropriately tough form of sterilisable plastics material may be used. The remaining components can be made either from a suitable metal or from a suitable sterilisable plastics material.

By making the instrument or parts thereof from a plastics material, the tool may be made lighter in weight and possibly cheaper to produce. Thus, a surgical instrument may be made fully disposable thereby avoiding the problems of the build up of contaminants within the instrument that can occur with tools intended for long term reuse.

Whether the instruments of the invention may be designed to be disposable or reusable, they should be formed from materials which are capable of withstanding the autoclaving or other sterilisation procedures typically used for surgical instruments. For autoclaving, such materials should preferably have the ability to withstand temperatures in excess of 134° without deforming or otherwise losing their integrity during the sterilising process.

One potential problem with surgical instruments used in laparoscopic techniques, and employing a coaxial actuator shaft arrangement, is that contaminants such as blood and other bodily fluids can migrate along the space between the inner and outer shafts and removal of such contaminants can be very difficult without dismantling the equipment after each use. In order to avoid this potential problem, in the instruments of the present invention, a sealing means may be provided between the actuator rod and effector tube to prevent or reduce substantially the likelihood of contaminants finding their way into the very small annular gap between the two. The sealing means could, for example, take the form of an O-ring or other seal formed from a low friction material which does not hinder movement of the actuator rod along the bore of the effector tube.

In order to eliminate completely the possibility of contaminants moving along the gap between the inner and outer coaxial shafts, the actuating rod may be provided with a flexible skirt which in turn is connected to the inner wall of the effector tube. The skirt acts as a barrier to contaminants.

Alternatively, the instrument may be constructed so as to be dismantled for cleaning and sterilising purposes.

The actuator mechanism illustrated in figures 1 and 2 is a simple "open and close" mechanism. However, in many instances, it may be desirable that the actuator mechanism should provide some form of locking means for locking the jaws of the tool in the gripping or closed position.

A second embodiment of the invention, which has such a locking facility, is shown in figure 3.

The instrument, of which the handle is shown in Figure 3, is similar in external appearance but has a modified actuator arrangement within the

handle. Thus, as with the instrument shown in Figures 1 and 2, the instrument has an elongate handle 101, and an actuator shaft with a surgical tool (not shown) mounted at its end. The handle 101 is shaped to enable it to be held in a pen-like grip between thumb, forefinger and index finger and has a bulbous region 104 at approximately its mid-point, and a pen handle tail piece 127. The bulbous portion conceals the actuator mechanism.

As with the embodiment of Figures 1 and 2, the shaft comprises an outer effector tube 112 and an actuating rod 111 slidably disposed within the effector tube 112. The effector tube 112 has a threaded end which screws into a threaded socket at the distal end of junction member 113. The actuating rod 111 on the other hand extends through a central bore in the junction member 113 and into the interior of the bulbous portion 104 where the actuating mechanism is located.

The actuation mechanism comprises a generally cylindrical housing 117, hereinafter referred to as the actuator retaining capsule. The actuator retaining capsule 117 has a threaded boss or spigot 117a extending axially from one end thereof, onto which is screwed the junction member 113. At the other end, i.e. the end furthest from the shaft 102, the actuator retaining capsule 117 is provided with an end piece 126 which fits tightly within the rearwardly facing open end of the capsule 117 and is secured therein by means of three small radially positioned screws (not shown). Alternatively, end piece 126 and capsule 117 can be secured together by means of a threaded union, adhesive, welding or by any other common fixing method.

End piece 126 has extending axially rearwardly therefrom a threaded spigot or boss portion 126a onto which is screwed the internally threaded pen handle tail piece 127 which is of elongate tapering form and, in this embodiment, is hollow for lightness.

Fixedly mounted (in this case by means of three small screws) within the actuator retaining capsule 117 is actuator cam release member 119. Actuator cam release member 119 has a rearwardly oriented spigot portion 119a which has a radially inwardly inclined end surface 119b, the purpose of the inclined end surface 119b being to assist in the dismantling of the instrument as will be described below. Spigot portion 119a serves as a support upon which is slidably mounted cam wheel actuator 121. Cam wheel actuator 121 has a plurality of inclined surfaces 121a separated by means of axially aligned dividing walls 121b. Each pair of adjacent dividing walls 121b and the inclined surface 121a therebetween define a camming slot 121c on the cam wheel. To the rear (i.e. furthest from the shaft) of the cam wheel actuator 121 is a grasping element or actuating cam wheel 122. The grasping element or actuating cam wheel 122 has a radially outer annular portion 122a which abuts against the inner surface of the actuator retaining capsule 117. Extending radially inwardly from the annular portion 122a are a plurality of grasping cams, each of which has a grasping portion 122c. The radially inner surfaces of each grasping portion 122c are provided with grooves 122b of a radius smaller than the radius of actuating rod 111 so as to enable the grasping cams to more positively grasp the actuating rod 111. In order to further enhance the grip of the grasping portions on the actuating rod 111, the surface of the actuating rod 111 may be roughened.

Disposed rearwardly of the actuating cam wheel 122 is an annular member 124 which is arranged for sliding movement within the actuator retaining capsule 117. Annular member 124 has a central recess for accommodating the end of actuating rod 111. A first return spring 123 is arranged between a front face 124a of the annular member and a rear face 122d of the annular portion 122a of the actuating cam wheel 122 so as to bias the actuating cam wheel against the cam wheel actuator 121.

Extending between the rear surface 124b of the annular member 124 and an end wall of the end piece 126 is a second return spring 125 which is

of greater stiffness than the first return spring 123.

The actuator retaining capsule 117 is provided with an array of slots 130 around its circumference at approximately its mid-point. Located outside the actuator retaining capsule 117 are a plurality of axially aligned actuating arms 131 arranged in an array around the circumference of the handle. In this embodiment, eight actuating arms 131 are provided although a smaller or greater number may be provided as desired. Each actuating arm is radially joined to a common hub 131a of wedge-shaped cross-section (e.g. by virtue of being integrally formed with the hub), the hub 131a being clamped between the junction member 113 and the end wall 117b of the capsule 117. The rearward end of each actuating arm 131 is not clamped but is held in place by means of the outer skin or boot 114 which is formed of a flexible material and encloses and seals the entire bulbous portion. The boot is held in place by virtue of its in-turned end 114a being clamped between junction member 113 and the end wall 117b of the capsule 117, and its rearward end being clamped between the inclined surface 126b of the capsule end portion 126 and the inner surface 127a of the tail piece.

Extending radially inwardly from about the mid-point of each actuating arm 131 is an actuating finger 120 the actuating finger being arranged to protrude through the slot 130 in the actuator retaining wall and into contact with the cam wheel actuator 121. Each actuator finger 120 has an inclined camming surface 120a which in this embodiment has a sloping angle complimentary to that of the inclined surface 121a of the camming slot of the cam wheel actuator 121.

Located forwardly of the cam wheel actuator 121 is a grasping cam wheel 118 which is identical in form to actuating cam wheel 122. Grasping cam wheel 118 is held in place by virtue of its annular rim portion 118a being held between an in-turned end wall 117c of the actuator retaining capsule 117 and an end face of the actuator cam release member 119. In

front of the grasping cam wheel 118 and slidably mounted on the actuating rod 111 is grasp releasing ring 116 which has a pair of generally conical surfaces 116a and 116b. The radially inner edge of the rearwardly facing surface 116b is radiussed, for reasons which will become apparent below.

Encircling the forwardly facing conical surface 116a of the grasp releasing ring 116 is grasp releasing actuator wheel 115 which comprises an array of spoke-like radial actuator elements 115a linked together at their radial outer ends by a thin flexible annulus 115b. The annulus 115b lies outside the actuator retaining capsule 117 and the actuator elements 115a extend into the interior of the capsule 117 through slots 117d. The actuator elements 115a protrude between adjacent pairs of actuator arms 131 and the flexible annulus 115b encircles the array of actuator arms 131, forming an annular bulge in the boot 114 which allows easy visual location of the grasp releasing mechanism.

In use, the handle of the instrument is held in a pen grip as with the instrument of Figures 1 and 2. In order to close the jaws of a surgical tool at the end of the shaft, the user depresses any one or more of the actuator arms 131 arranged around the circumference of the handle. Depressing the actuator arm 131 causes the inclined camming surface of the associated actuating finger 120 to be urged into a camming slot 121c of the cam wheel actuator 121 and into contact with the inclined surface of the camming slot 121c. As the inclined camming surface 120a of the actuating finger cams along the inclined surface 121a of the cam wheel actuator, it causes the cam wheel actuator 121 to be urged rearwardly along the spigot portion 119a of the actuator cam release member 119. This in turn has the effect of urging the actuating cam wheel 122 rearwardly against the biasing force of the first return spring 123 and, since the cams of actuating cam wheel 122 are in tight gripping contact with the actuating rod 111, also causes the actuating rod 111 to move rearwardly thereby causing the jaws of the tool to close. In the absence of the grasping cam wheel 118, the force of the

second return spring 125 would cause the annular member 124 to push the actuator rod 111 back along the effector tube 112 thereby opening the jaws of the tool at the end of the shaft. However, because the cams of the grasping cam wheel 118 are in gripping contact with the actuating rod 111, the rod 111 is prevented from moving back along the effector tube 112 and thus the tool remains locked in the grasping position. In order to release the actuator shaft, the user depresses the grasp releasing actuator wheel 115 at any point or points on its circumference, thereby urging the spoke-like radial actuator elements 115a inwardly and into contact with the forward conical surface 116a of the grasp releasing ring 116. As the inclined surface of the actuator element 115a cams along the conical surface 116a, it forces the grasp releasing ring 116 in a rearwards direction against the grasping cam wheel 118. The flexibility of the thin web portion 118b of the grasping cam wheel 118 enables the grasp releasing ring 116 to force the radially innermost grasping portions (cams) of the cam wheel 118 slightly apart thereby releasing their grip on the actuating rod 111 which is then restored to its rest position by the force of the second return spring 125, and the jaws of the tool at the end of the shaft are caused to open.

The surgical instrument shown in Figure 3 is designed such that the effector tube and actuating rod can be removed and disposed of at the end of each surgical operation, or alternatively sterilised and re-used. Removal of the effector tube 112 is achieved simply by unscrewing it from the junction member 113. The actuating rod 111 is then removed by pulling it out from the handle 101. Although the grasping cam wheel 118 and the actuating cam wheel 122 initially act to prevent retraction of the actuating rod from the handle, the gripping effect of the grasping cam wheel 118 is released by depressing the surface of the grasp releasing actuator wheel 115 in the manner described above whilst the gripping effect of the actuating cam wheel 122 is automatically released as the grasping portions 122c are pulled against the inclined surface of the actuator cam release

member 119 which leads to the grasping portions 122c being forced apart sufficiently to release the actuating rod 111.

Once the actuating rod and effector tube have been removed, the handle and actuator mechanism in the handle may be sterilised for reuse. At the start of the next surgical procedure, a new actuating rod 111 and effector tube 112 arrangement may simply be fitted by pushing the actuating rod into the handle until it engages and is gripped by the grasping cam wheel 118 and actuating cam wheel 122 and then screwing the effector tube 112 into place as described above. By making the actuator rod and effector tube disposable, the potential problem of blood, other bodily fluids and tissue contaminating the instrument is avoided.

Figures 4 to 7b illustrate grasping forceps in accordance with a third embodiment of the invention. As with the embodiment shown in the previous Figures, the grasping forceps has a handle, a shaft and a surgical tool (not shown) mounted at its end. The handle is shaped so as to enable it to be held in a pen-like grip between thumb forefinger and index finger and, as with the previous embodiments, has a bulbous region at approximately its mid-point, and a pen-handle tail piece. From the exterior, the grasping forceps appear very similar to the instruments of Figures 1 to 3. However, the bulbous region conceals a modified actuation mechanism.

The actuation mechanism comprises a generally cylindrical housing (hereinafter referred to as the actuator retaining capsule) formed from a front capsule portion 206 and a rear capsule portion 210 each of generally closed ended cylindrical form. The two capsule portions 206 and 210 are connected together by means of a capsule junction block 224. The rear end of the capsule junction block 224 is received within the end of rear capsule portion 210 and is held in place by means of a pair of screws 207, only one of which is shown in the drawings. The leading portion of the capsule

junction block 224 has an external thread 223 which engages an internal thread on the front capsule portion 206. Rear capsule portion 210 has extending rearwardly therefrom a threaded spigot 215 which engages an internal thread on the tapering pen-handle tail piece 216. The front capsule portion 206 also has a threaded spigot 218, onto which is screwed internally threaded junction member 201. The inner surface of the distal end of the junction member has a thread 217 into which the effector tube (not shown) can be screwed.

A cam wheel actuator 228 is slidably disposed within the rear end of the actuator retaining capsule. Cam wheel actuator 228 has a central bore which is threaded to engage and retain a correspondingly threaded end of the actuating rod 230. Cam wheel actuator 228 is biased forwardly by means of return spring 229.

As with the instruments illustrated in Figures 1 to 3, the cam wheel actuator has a plurality (in this case 12) of inclined surfaces 227a around its outer circumference, each inclined surface 227a being separated from an adjacent inclined surface by means of axially aligned dividing walls 227b. The inclined surfaces 227a and dividing walls 227b, together with the radial slots 231 of rear surface 224a of the capsule junction block 224 define pockets into which actuating wedges 208 are located. Actuating wedges 208, which are shown in enlarged form in Figures 7a and 7b, extend outwardly through slots 209 in the wall of rear capsule portion 210. The radially innermost ends of the actuating wedges 208 are tapered to allow them to be depressed closer to the central axis. An array of generally arcuate actuating arms 211 are arranged about the capsule such that their mid-sections bear against and hold in place the actuating wedges 208. The actuating arms 211 are linked at one end by means of a common hub 211a, the arrangement of the arms 211 with respect to the hub 211a being shown in Figure 5. The hub 211a sits about the spigot 218 of the forward capsule portion and is surrounded by an annular collar 202. The ends 211b of the

actuating arms remote from the common hub 211a taper and are retained within scalloped recesses 212 in an annular flange extending radially outwardly from the rear capsule portion. The ends 211b of the arms are held in place in the scalloped recesses by means of an annular collar 214 which encircles the end of the rear capsule portion 210.

The actuator retaining capsule, actuating wedges 208 and actuating arms 211 are surrounded and concealed by a flexible boot 213 formed of an appropriately flexible thin plastics material. The flexible boot 213 has in-turned end portions 213a and 213b which are clamped between the junction portion 201 and the front capsule portion 206, and the pen-handle tail piece 216 and rear capsule portion 210 respectively.

In use, actuation of the tool is achieved by depressing the flexible boot 213 and underlying actuating arms 211 and actuating wedges 208 to force the actuating wedges 208 radially inwardly in the slots 231. As the actuating wedges 208 move radially inwardly, so the inclined surfaces 208a cam along the inclined surfaces 227a of the cam wheel actuator 228 thereby urging the cam wheel actuator 228 against the force of return spring 229 in a rearwards direction. Since the actuating rod 230 is screwed into the cam wheel actuator 228, the actuating rod is also moved rearwardly thereby actuating the surgical tool at the end of the actuator shaft, in a manner similar to that described in relation to Figures 1 to 3.

When pressure on the flexible boot 213, actuating arm 211 and actuating wedge 218 is released, the cam wheel actuator and actuating rod 230 remain locked in the retracted position, thanks to a grasping mechanism mounted in the capsule portion, as will now be described.

As can be seen from Figure 4 and Figure 6, the actuating rod 230 has a threaded end 230a which screws into the cam wheel actuator 228 and a second threaded region 222 which has a much finer thread (smaller pitch)

than threaded end 220a. A pair of disc springs 221a and 221b surround the finely threaded region 222 on the actuating rod 230 and are clamped in place between opposing surfaces 206b and 224b of the front capsule portion 206 and capsule junction block 224 respectively.

The disc springs 221a and 221b, which are formed from a suitably resilient metal material, each have a plurality (in this case twelve) of radially inwardly directed grasping fingers 221c, 221d. The rear disc spring 221b has an inner diameter slightly less than the outer diameter of the finely threaded region 222 on the actuating rod 230. The forward disc spring 221a has an inner diameter larger than the outer diameter of the finely threaded region 222. Disposed about the finely threaded region 222 and forwardly of the disc springs is a grasp releasing cam wheel 219 which has a plurality of inclined camming surfaces 220a separated by axially aligned dividing walls 220b which together define angled slots 220. The rear surface of the grasp releasing cam wheel 219 is provided with a second inclined camming surface 219a.

In this embodiment, the grasp releasing cam wheel 219 has an array of twelve angled slots 220 and these are staggered relative to the slots 231 defined by the capsule junction block 224 and cam wheel actuator 228. Each slot 220 has disposed therein a grasp releasing wedge 204, the radially outer end of which protrudes through slots 205 in the front capsule portion 206, between the actuating arms 211, and through slots 203 in the annular collar 202. The radially outer ends of the grasp releasing wedges 204 are accommodated within an annular bulge 213a in the flexible boot 213.

In use, as the actuator mechanism is actuated to move the actuating rod 230 in a rearwards direction towards the user, the fine thread 222 and the grasping fingers 221d of the rear disc spring 221b cooperate to form a ratchet mechanism which holds the actuating rod 230 in the retracted position against the forward biasing force of the return spring 229. In this

way, a grasping forceps tool at the forward end of the instrument can be locked in a clamping or grasping position. The effect is to give a large number of grasping positions within a short travelling distance of the actuating rod 230 (number of positions = [travel ÷ pitch] x number of fingers, typically [1.5 ÷ 0.25] x 12 = 72).

When it is desired to release the actuating rod 230, one or more of the grasp releasing wedges 204 are depressed such that the inclined camming surfaces 204a on the grasp releasing wedges 204 cam along the inclined surfaces 220a of the angled slots 220 to urge the grasp releasing cam wheel 219 in a rearwards direction. As the grasp releasing cam wheel 219 moves in a rearwards direction, it lifts the fingers 221d of the rear disc spring 221b away from the finely threaded portion 222 thus releasing their grasp on the actuating rod 230. The actuating rod 230 is then free to move in an axial direction and is urged forwardly again by the return spring 229. At the same time, the forward disc spring 221a acts as a return spring for the grasp releasing cam wheel 219 and urges it forwardly against the grasp releasing wedges 204 thereby displacing the grasp releasing wedges 204 outwardly to their rest position.

Figure 8 illustrates a simple forceps arrangement which makes use of the same actuator retaining capsule and actuating arrangement as shown in Figure 4 but omits the grasping/locking mechanism and the grasp releasing mechanism at the forward end of the capsule. Thus in this embodiment, depression of the actuating arms 211 and actuating wedges 208 displaces the cam wheel actuator 228 rearwardly against the force of the return spring 229, but once the pressure on the actuating arms 211 and actuating wedges 208 is released, the return spring 229 restores the cam wheel actuator and hence the actuating rod 230 to its original position. Thus, as with the surgical instrument of Figure 1, the instrument of Figure 8 provides only a simple "open and close" mechanism.

Figure 9 illustrates a further modification to the grasping forceps shown in Figure 4. In this embodiment, one of the grasp releasing wedges 204 is replaced by a grasp disabling wedge 331 the shape of which is illustrated more clearly in Figure 10. The grasp disabling wedge is similar in shape to the grasp releasing wedge 204 in the embodiment of Figure 4 except that it is slightly longer and the radially inner end of the wedge has a hooked shape or toe 332 defined by inclined surfaces 332a and 332b. The corresponding guide slot 333 has a cut away region or overhang 336 defined by inclined surface 336a and ridge 336b. The grasp disabling wedge 331 is biased radially outwardly by means of a biasing leaf spring 334 which is mounted at one end in a slot 335 on the grasp releasing wedge 331 and at the other end is secured to the outer surface of the capsule by means of a retaining screw (not shown). The grasp disabling wedge 331 stands proud of the grasp releasing wedges 211 and the radially outer end 331a of the grasp disabling wedge is located in a small radial extension of the annular bulge on the flexible boot 213.

In use, in order to disable the grasping mechanism, the grasp disabling wedge 331 is depressed, along with some of the grasp releasing wedges 204, such that hook or toe 332 snaps over the ridge 336b and, in so doing, the grasp releasing cone is urged in a rearwards direction to lift the grasping fingers 221d of the disc spring 221b away from the fine threaded region 222. On releasing, the grasp disabling wedge 331 prevents the fingers 221d from re-engaging thus disabling the grasping mechanism. When the instrument is subsequently actuated by depressing the actuating arms 211 and actuating wedges 208, since the ratchet mechanism defined by the fine thread region 222 and the disc spring 221b has been disabled, the return spring 229 restores the actuating rod 230 to its original position when the pressure on actuator fingers 211 and actuator wedges 208 is released. In order to re-enable the grasping mechanism, one or more of the eleven grasp releasing wedges 204 are depressed thus urging the grasp releasing cone 219 in a rearwards direction, thereby

Figure 9 illustrates a further modification to the grasping forceps shown in Figure 4. In this embodiment, one of the grasp releasing wedges 204 is replaced by a grasp disabling wedge 331 the shape of which is illustrated more clearly in Figure 10. The grasp disabling wedge is similar in shape to the grasp releasing wedge 204 in the embodiment of Figure 4 except that it is slightly longer and the radially inner end of the wedge has a hooked shape or toe 332 defined by inclined surfaces 332a and 332b. The corresponding guide slot 333 has a cut away region or overhang 336 defined by inclined surface 336a and ridge 336b. The grasp disabling wedge 331 is biased radially outwardly by means of a biasing leaf spring 334 which is mounted at one end in a slot 335 on the grasp releasing wedge 331 and at the other end is secured to the outer surface of the capsule by means of a retaining screw (not shown). The grasp disabling wedge 331 stands proud of the grasp releasing wedges 211 and the radially outer end 331a of the grasp disabling wedge is located in a small radial extension of the annular bulge on the flexible boot 213.

In use, in order to disable the grasping mechanism, the grasp disabling wedge 331 is depressed, along with some of the grasp releasing wedges 204, such that hook or toe 332 snaps over the ridge 336b and, in so doing, the grasp releasing cone is urged in a rearwards direction to lift the grasping fingers 221d of the disc spring 221b away from the fine threaded region 222. On releasing, the grasp disabling wedge 331 prevents the fingers 221d from re-engaging thus disabling the grasping mechanism. When the instrument is subsequently actuated by depressing the actuating arms 211 and actuating wedges 208, since the ratchet mechanism defined by the fine thread region 222 and the disc spring 221b has been disabled, the return spring 229 restores the actuating rod 230 to its original position when the pressure on actuator fingers 211 and actuator wedges 208 is released. In order to re-enable the grasping mechanism, one or more of the eleven grasp releasing wedges 204 are depressed thus urging the grasp releasing cone 219 in a rearwards direction, thereby

releasing the grasp disabling wedge 331 which is restored to its rest position by the return spring 334.

Figures 11 and 12 illustrate a further embodiment of the invention in the form of a diathermy instrument. In this embodiment, the actuating mechanism is similar to that shown in the preceding embodiments, except that the mechanical components of the actuator retaining capsule have been largely replaced by electrical components.

As shown in Figures 11 and 12, the actuating mechanism comprises an actuator retaining capsule, actuating wedges and an array of actuating fingers surrounded by a flexible boot of the same type as shown in Figure 4, the simple forceps arrangement. The two halves of the actuator capsule are held together by means of junction block 412 which is threaded to engage corresponding threads on the front capsule portion, and is secured to rear capsule portion by means of screws (not shown). In this embodiment however, the junction block is modified in shape to accommodate electrical contact block 408 and wiring location ring 409.

The rear portion of the actuator retaining capsule contains a cam wheel actuator 415 having an axially short contacting surface 416a and an axially longer contacting surface 416b. Mounted behind the cam wheel actuator 415 within recess 421 are a pair of micro switches 418 and micro switch contact springs 417a and 417b. Contact springs 417a and 417b are connected by means of an annular ring which is held in place by clamping between switch block 419 and the inner end wall of the rear capsule portion. A power supply cable 403 enters the pen-handle tail piece of the tool and extends into the capsule where it is connected to micro switches 418 and capacitors 420. Wires 414 extend between micro switches 418 and actuator contact rings 406 and 407 in the forward part of the actuator capsule. Electrical contacts 404 and 405 protruding from the effector end 410 engage the actuator contact rings 406 and 407 respectively and

electrical wires 401 extend along the interior of the effector tube to a diathermy hook (not shown) at the end thereof.

The effector tube end 410, which has an axial split 411, abuts against a conical portion 413 of the junction block 412. As the effector tube is screwed into the conical junction member by means of thread 402, the two halves of the split end of the effector tube 410 are forced apart by the conical portion 413 thereby ensuring positive contact between the electrical contacts 404 and 405 and the actuator contact rings 407 and 406 respectively.

In use, the diathermy instrument is actuated in a similar manner to the instruments shown in Figures 1 to 10; i.e. the actuator arms and actuator wedges arrangement surrounding the retaining actuator capsule are depressed so as to urge the cam wheel actuator 415 in a rearwards direction. An inclined surface 416b on the cam wheel actuator 415 cams along the in-turned end of micro switch contact spring 417b to depress the micro switch thereby switching on a source of current to the effector contact 404. The current provided by switch 417a is sufficient to provide enough heat at the diathermy hook for coagulation, but is insufficient to generate a temperature which can efficiently cut through tissue. When it is desired to use the diathermy hook to cut through tissue, the actuator arm 411 and actuator wedge 408 are further depressed so as to displace the cam wheel actuator 415 rearwardly such that the shorter actuator contacting surface 416a engages the in-turned end of micro switch contact spring 417a to actuate micro switch 418a. This permits a current suitable for tissue cutting to flow through the wires along the effector rod to the diathermy hook. On releasing, the actuator cam wheel 415 is returned to its rest position by a return spring (not shown) contained in cavity 421, and acting on the rear of the actuator cam wheel 415 and the end of a cavity in the switch block 419.

It will readily be apparent that numerous modifications and alterations may be made to the surgical instruments shown in the drawings and specifically described above, without departing from the principles underlying this invention. All such modifications and alterations are intended to be embraced by this application.

CLAIMS

1. A surgical instrument comprising a handle shaped to enable it to be freely rotated by the user's fingers about its longitudinal axis in the hand of the user, and held by the user at any angle of rotation about its longitudinal axis; the handle having an elongate shaft extending therefrom and a surgical tool mounted on the shaft at a location remote from the handle; the handle being provided with actuator means operatively linked through the shaft to the surgical tool; the actuator means having an actuator surface or surfaces extending around substantially the entire circumference of the handle, whereby the actuator means is operable by applying pressure at substantially any circumferential location on the actuator surface or surfaces, to actuate the surgical tool.

2. A surgical instrument according to claim 1 wherein the actuator surface is a continuous surface extending around the circumference of the handle.

3. A surgical instrument according to claim 1 wherein the actuator surface comprises an array of closely spaced discrete actuator elements.

4. A surgical instrument according to any one of the preceding claims wherein the actuator means is mechanical, electrical, pneumatic or hydraulic or any combination thereof.

5. A surgical instrument according to any one of the preceding claims wherein the actuator means is mechanically linked to an actuating rod disposed slidably within the elongate shaft, which rod is in turn linked to the surgical tool on the end of the shaft.

6. A surgical instrument according to any one of claims 1 to 4 wherein the actuator means comprises a switch or array of switches for controlling a flow of electrical current along the shaft to a diathermy tool at the end thereof.

7. A surgical instrument according to any one of claims 1 to 5 wherein the surgical tool is a miniaturised surgical instrument selected from forceps, clamps, scissors or diathermy hooks.

8. A surgical instrument according to claim 7 wherein the surgical tools have a monopolar or bipolar diathermy capability.

9. A surgical instrument according to any one of the preceding claims wherein the actuator means is an array of radially displaceable actuator elements disposed around the circumference of the handle, means being provided for converting radial inward movement of an actuator element into longitudinal movement of an actuating rod within the elongate shaft.

10. A surgical instrument according to claim 9 wherein the actuator element is provided with an edge or surface which functions as a cam follower or camming surface, for engaging and camming against a complimentary camming surface or cam follower associated with the actuating rod.

11. A surgical instrument according to claim 10 wherein each actuator element is provided with a wedging member having an inclined surface whereby radially inward movement of the actuator element urges the inclined surface of the wedging member into contact with a camming edge or surface associated with the actuator shaft, thereby to displace the camming edge or surface in a longitudinal direction.

12. A surgical instrument according to any one of claim 9 to 11 having at least three actuator elements.

13. A surgical instrument according to claim 12 wherein there are at least six actuator elements.

14. A surgical instrument according to any one of the preceding claims wherein the handle is of elongate form and is sufficiently small in cross-section to enable it to be held in a pen-like grip.

15. A surgical instrument according to any one of the preceding claims wherein the handle has a bulbous shape, being tapered towards the end remote from the surgical tool, increasing in diameter towards the central portion thereof and tapering again towards the actuator shaft.

16. A surgical instrument according to claim 15 wherein the actuator means is located within the bulbous or enlarged diameter central portion of the handle.

17. A surgical instrument according to any one of the preceding claims wherein the handle is provided with means for effecting locking of the surgical tool in a given configuration.

18. A surgical instrument according to claim 17 wherein the surgical tool is in the form of a miniature pair of grasping forceps or a clamping tool and the locking means is effective to lock the forceps or clamping tool in a clamping or gripping configuration.

19. A surgical instrument according to claim 17 or claim 18 wherein the handle is provided with first actuator means for effecting movement of a surgical tool at the end of the actuator shaft from a rest position

to an actuated position; locking means for locking the surgical tool in the actuated position; and second actuator means operable to release the locking means to enable the surgical tool to return to the rest position.

20. A surgical instrument according to claim 19 wherein the actuator means is mechanically linked to an actuating rod disposed slidably within the elongate shaft, which rod is in turn linked to the surgical tool on the end of the shaft, the locking means taking the form of a grasping member having a plurality of grasping portions which grasp the actuating rod to lock it in an actuating position, the second actuator means being operable to force the said grasping portions apart to release the grip on the actuating rod.

21. A surgical instrument according to claim 20 wherein the actuating rod is provided with a spiral track or an array of annular ridges which cooperate with the grasping portions to form a ratchet mechanism.

22. A surgical instrument according to claim 21 wherein the spiral track is a fine thread.

23. A surgical instrument according to any one of claims 19 to 22 wherein the second actuator means is arranged to be actuable from substantially any position around the circumference of the handle.

24. An actuator device comprising an actuating rod movable in a reciprocating manner along an axis, the actuating rod having a grasping region defined by a length of the rod having a spiral track at the surface thereof; biasing means for resiliently biasing the actuating rod in a first direction; actuator means for moving the actuating rod in a second direction opposite to the first direction

against a restoring force of the biasing means; grasping means comprising a plurality of grasping portions for grasping the actuating rod at the grasping region to hold the rod in an actuated position against the said restoring force; and grasp releasing means for releasing the actuating rod from the grasping means.

25. An actuator device according to claim 24 wherein the spiral track is a fine thread.

26. An actuator device according to claim 24 or claim 25 wherein the plurality of grasping portions take the form of an annular array of radially inwardly directed grasping fingers formed from a resilient material.

27. An actuator device according to claim 26 wherein the annular array of radially inwardly grasping fingers are constituted by a metal disk spring.

28. An actuator device according to claim 26 or claim 27 wherein the clearance between the radially inner most edges of opposing grasping fingers is less than the diameter of the actuating rod; such that as the actuating rod is urged through the grasping means in one direction, the grasping fingers engage the spiral track at the surface of the actuating rod to prevent movement of the actuating rod in the reverse direction.

29. An actuator device according to any one of claims 24 to 28 wherein the grasp releasing means takes the form of a grasp releasing member having a conical or frustoconical surface which can be urged in an axial direction against the grasping fingers to lift them away from the spiral track to release the actuating rod.

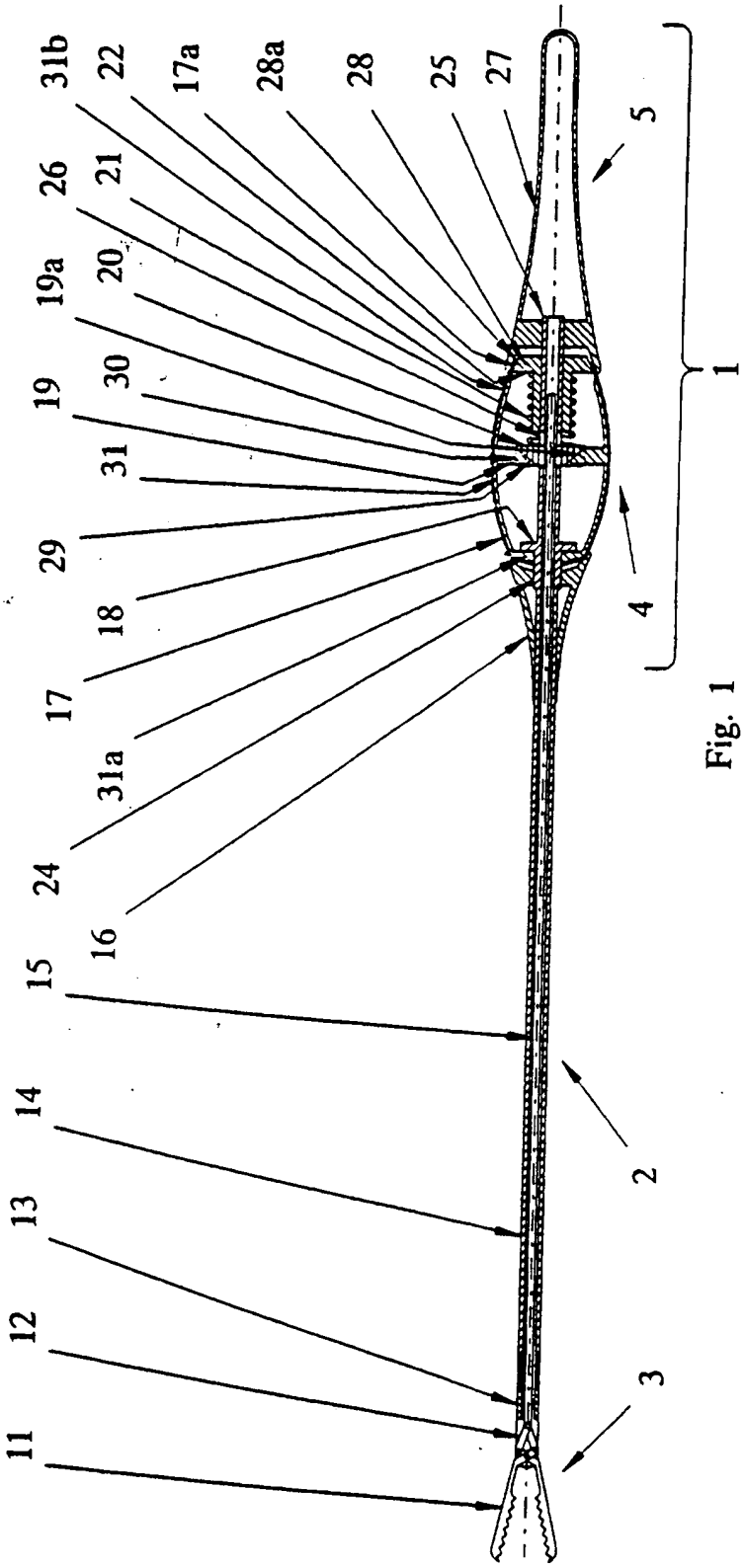

31b
22
17a
28a
28
25
27
5
26
21
20
19a
19
30
31
29
18
17
31a
24
16
15
14
13
12
11
4
1
2
3

Fig. 1

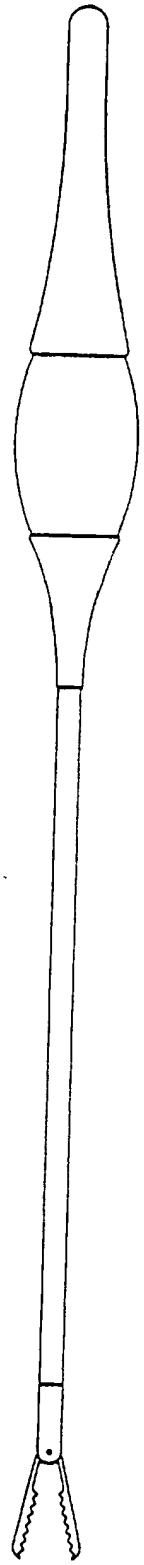


Fig. 2

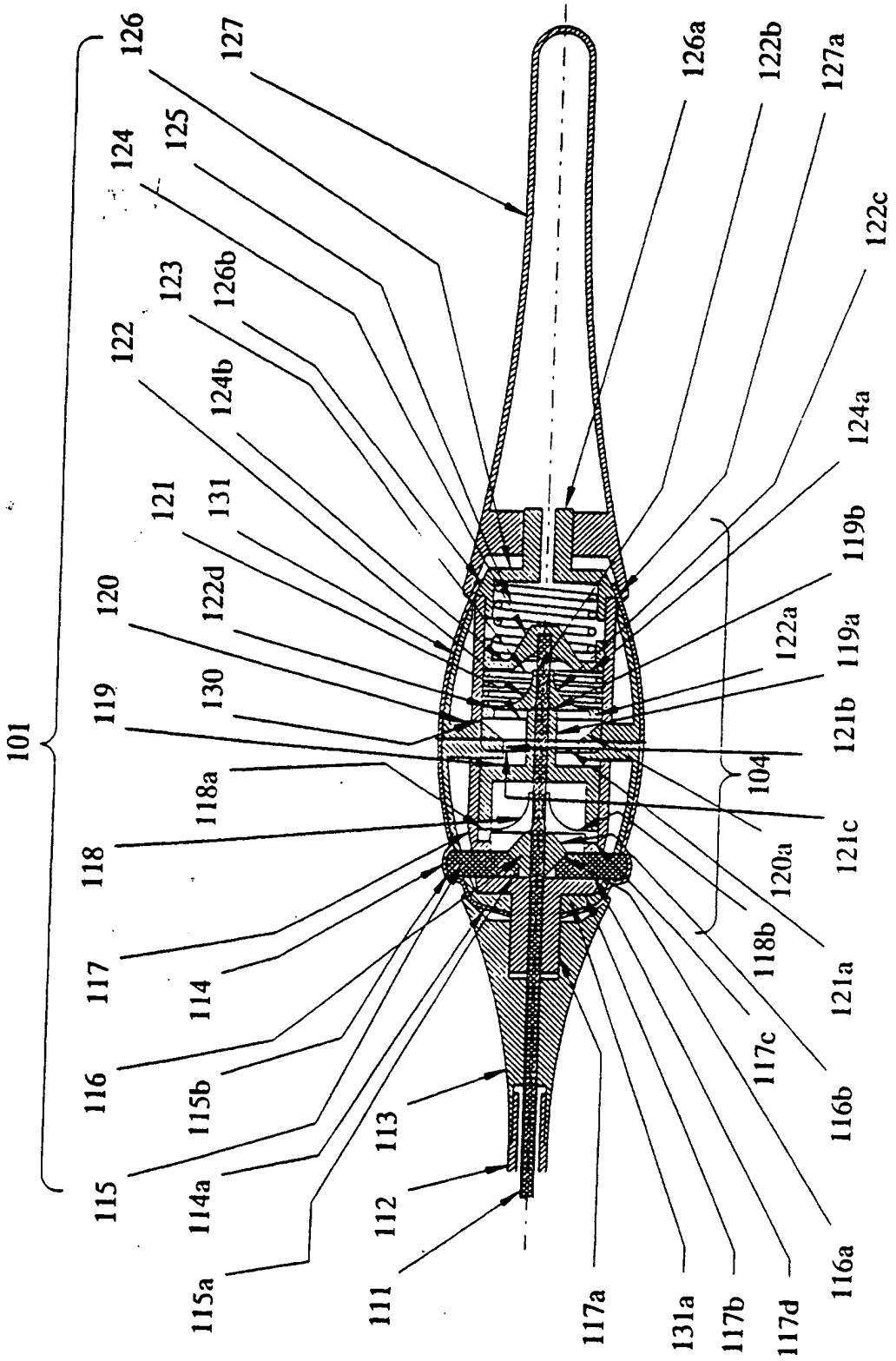

101
126
127
124
125
123
126b
122
124b
121
131
120
122d
119
130
118a
118
117
114
116
115b
115
114a
115a
111
112
113
117a
131a
117b
117d
116a
117c
116b
121a
118b
120a
121c
104
121b
119a
122a
119b
124a
122c
127a
122b
126a

Fig. 3

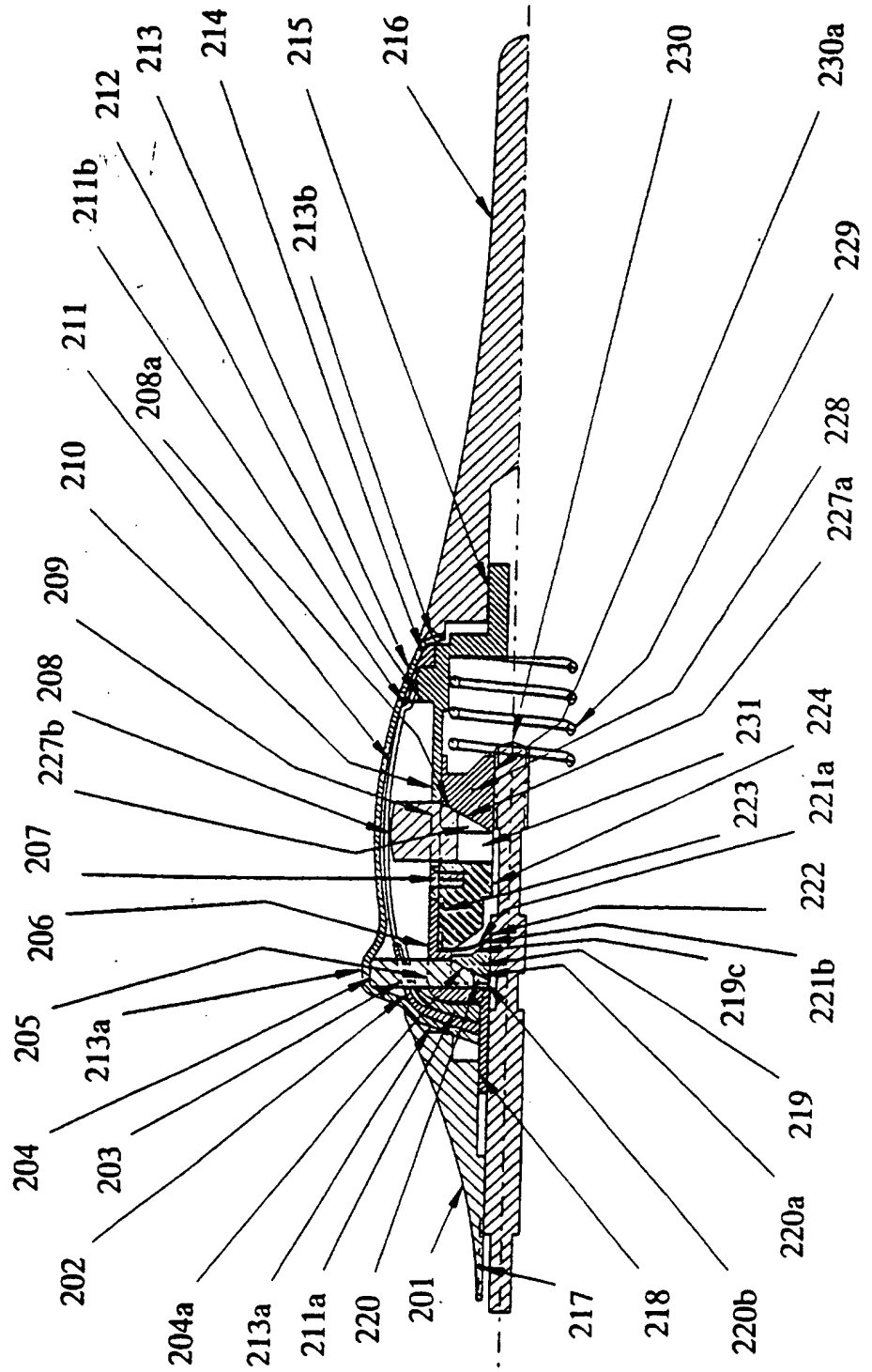

202
204
203
205
213a
206
207
227b
208
209
210
211
208a
211b
212
213
214
215
216
213b
230
230a
229
228
227a
224
231
223
221a
222
219c
221b
219
220a
220b
218
217
201
220
211a
213a
204a

Fig. 4

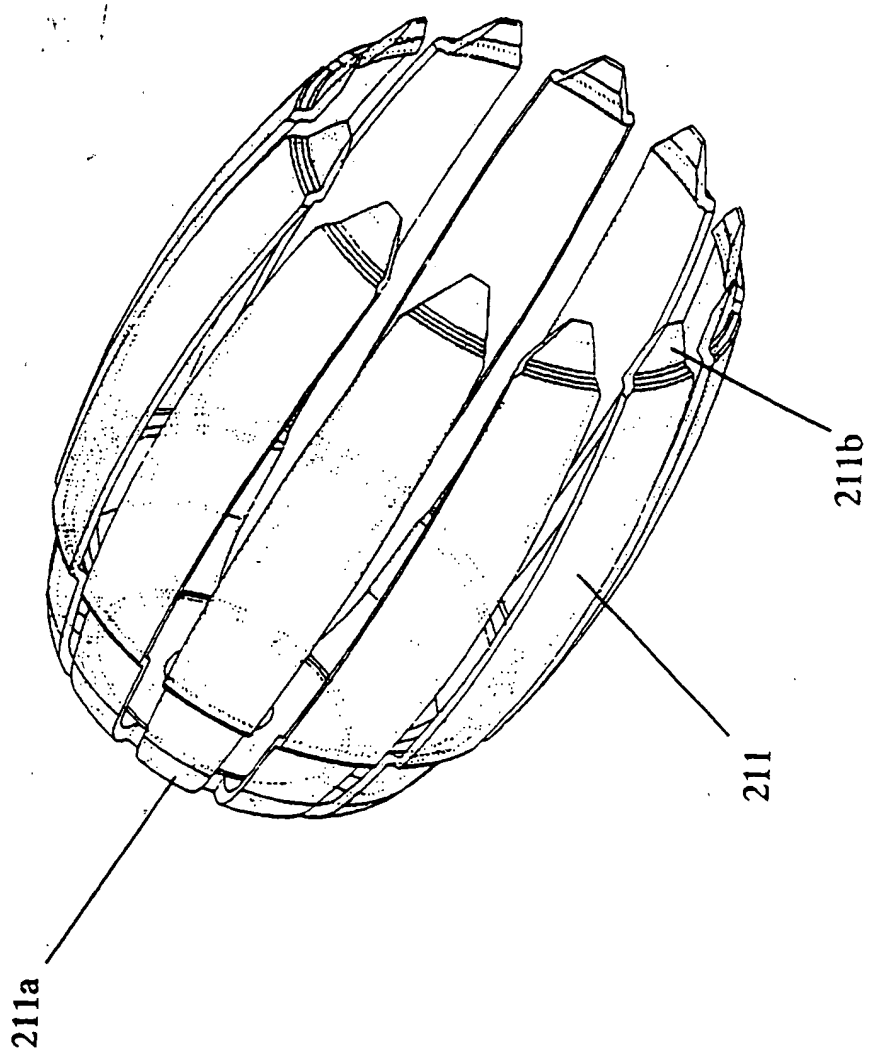


Fig. 5

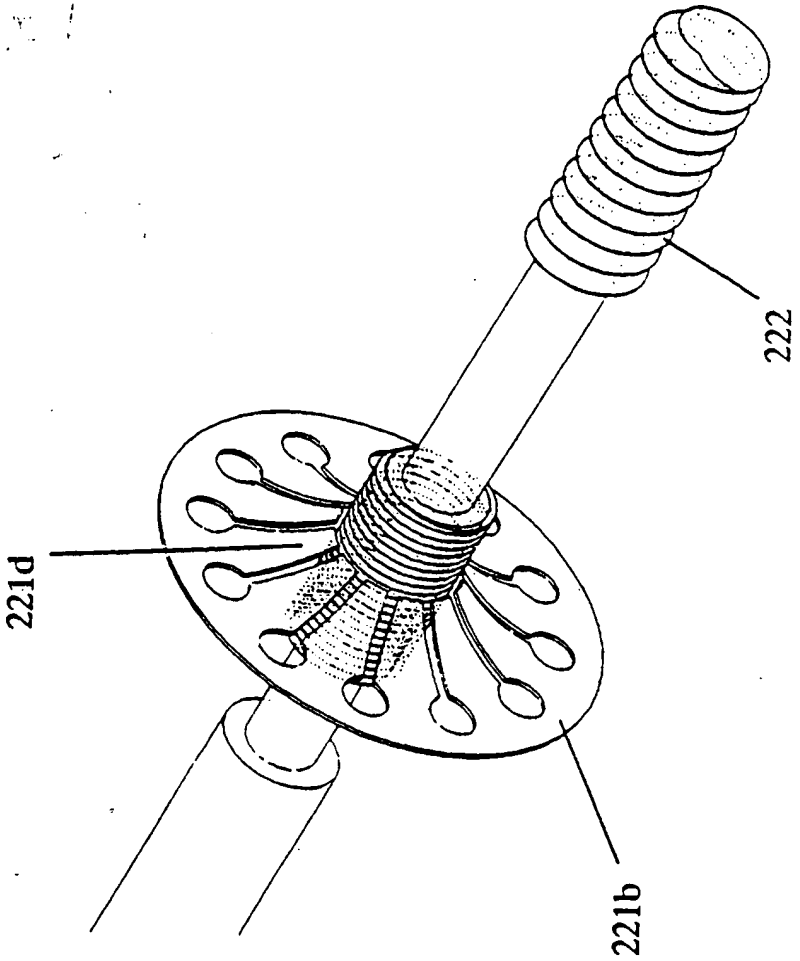


Fig. 6

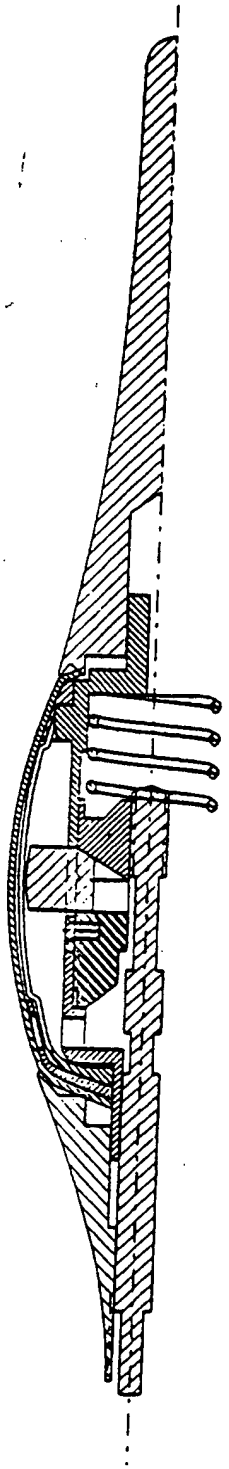


Fig. 8

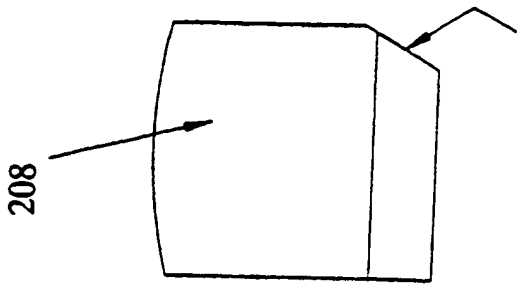


Fig. 7a

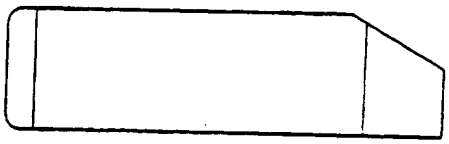


Fig. 7b

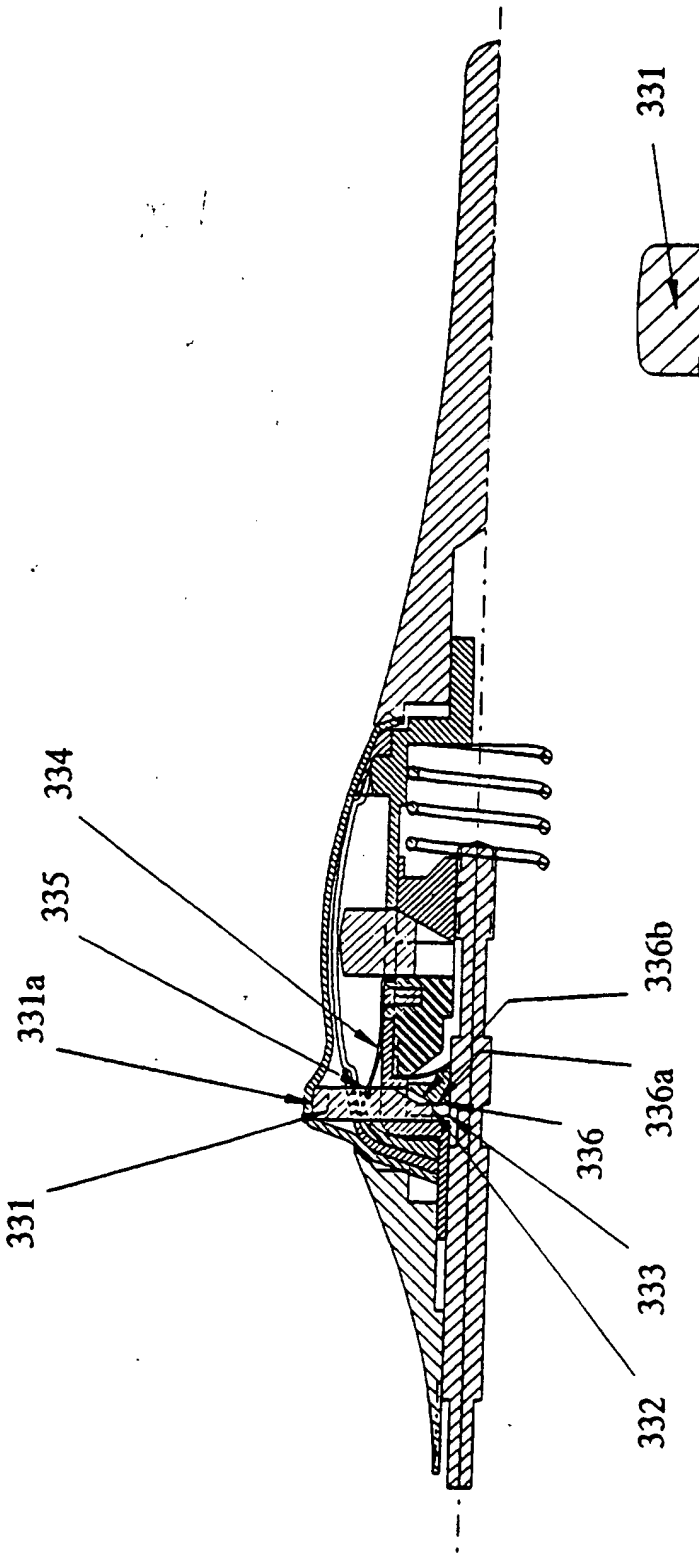


Fig. 9

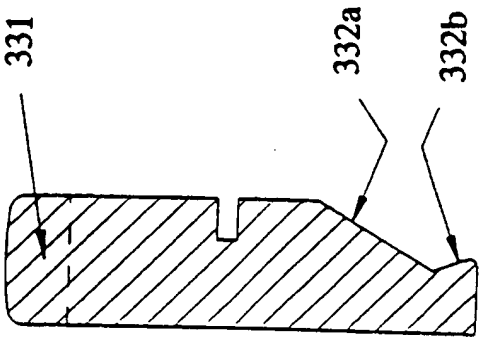


Fig. 10

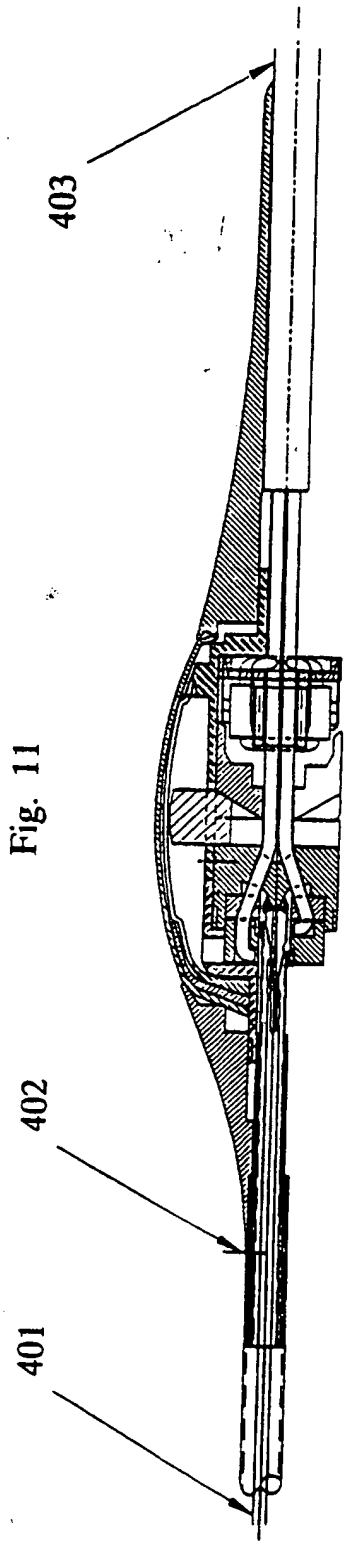

403
402
401

Fig. 11

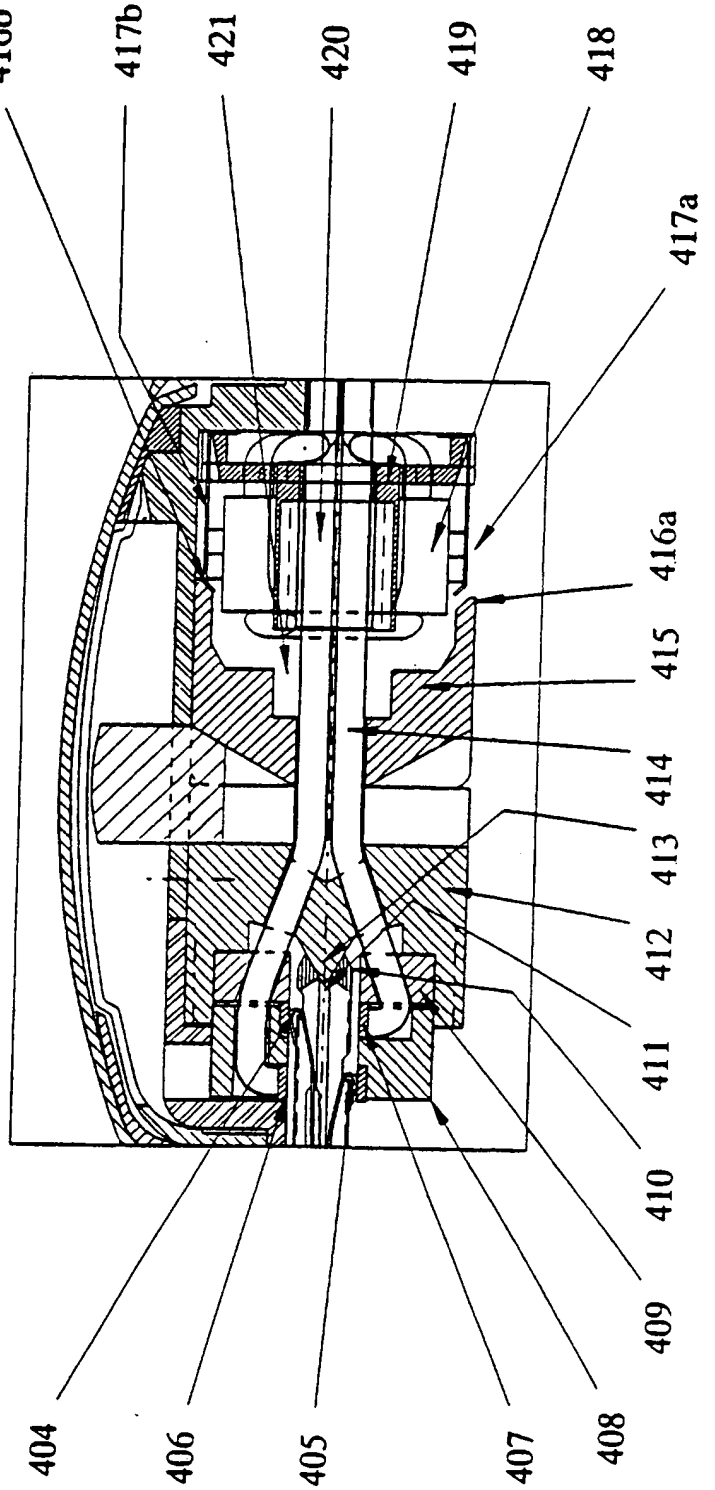

416b
417b
421
420
419
418
417a
416a
415
414
413
412
411
410
409
404
406
405
407
408

Fig. 12

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 96/00161

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61B17/28 A61B17/39 A61B17/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	DE,A,35 26 821 (HENSLER) 5 February 1987 see abstract; figures 2,4	1-5,7,9, 12-16 8,10, 17-20,23
X	US,A,5 355 871 (HURLEY) 18 October 1994 see column 2, line 45 - line 47; figure 2	1-5,7,9, 12-16
X	US,A,3 746 814 (LACKEY) 17 July 1973 see abstract; figures 1,2	1-4,6-8, 12-14
X	DE,A,24 60 481 (DELMA) 24 June 1976 see claims; figures	1,2,4, 6-8,15, 16

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 July 1996	24.07.96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Barton, S

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte. ...nal Application No
PCT/GB 96/00161

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,5 195 507 (BILWEIS) 23 March 1993 see abstract; figures	1,2,4
Y A	DE,A,42 11 417 (REMA) 7 October 1993 see column 3, line 37; figures 1,8	8,10 11
Y A	FR,A,2 701 832 (BLUET) 2 September 1994 see page 1, line 5 - line 6; figures 1,3	17-20,23 24
A	EP,A,0 217 559 (ADVANCED) 8 April 1987 see abstract; figures 1,3	21,22,24
A	US,A,5 176 700 (BROWN) 5 January 1993 see figure 1	17-19,24
A	DE,A,41 31 494 (HEIDMÜLLER) 1 April 1993 see abstract; figure 1	17-20,24
A	US,A,4 760 848 (HASSON) 2 August 1988 see abstract	17,23

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter ional Application No
PCT/GB 96/00161

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE-A-3526821	05-02-87	NONE		
US-A-5355871	18-10-94	NONE		
US-A-3746814	17-07-73	DE-A-	2262209	05-07-73
		JP-A-	48069392	20-09-73
DE-A-2460481	24-06-76	NONE		
US-A-5195507	23-03-93	FR-A-	2668695	07-05-92
		AT-T-	137943	15-06-96
		AU-B-	639153	15-07-93
		AU-B-	8706291	14-05-92
		CA-A-	2055032	07-05-92
		DE-D-	69119567	20-06-96
		EP-A-	0490714	17-06-92
DE-A-4211417	07-10-93	NONE		
FR-A-2701832	02-09-94	NONE		
EP-A-217559	08-04-87	US-A-	4743230	10-05-88
		CA-A-	1257826	25-07-89
		JP-C-	1698216	28-09-92
		JP-B-	3063910	03-10-91
		JP-A-	62117567	29-05-87
US-A-5176700	05-01-93	NONE		
DE-A-4131494	01-04-93	WO-A-	9305717	01-04-93
US-A-4760848	02-08-88	NONE		